AMERICAN GAS ASSOCIATION MONTHLY

A. G. A. Convention Opens October 10
at Atlantic City, N. J.

Electrical Methods for Estimating Corrosiveness Of Soils
SCOTT EWING

A. G. A. President Calls Home Service Workers Good Will Builders

Act to Bring Gas Summer Air-Conditioning To Commercial Stage

Local Companies Aid National Contest to Help House Heating Sales

Master Plumbers Find Cooperative Merchandising Plan Success in First Year

August 1932

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AMERICAN GAS ASSOCIATION MONTHLY

VOLUME XIV | AUGUST, 1932 | NUMBER 8

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The Association does not hold itself responsible for statements and opinions contained in papers and discussions appearing herein.

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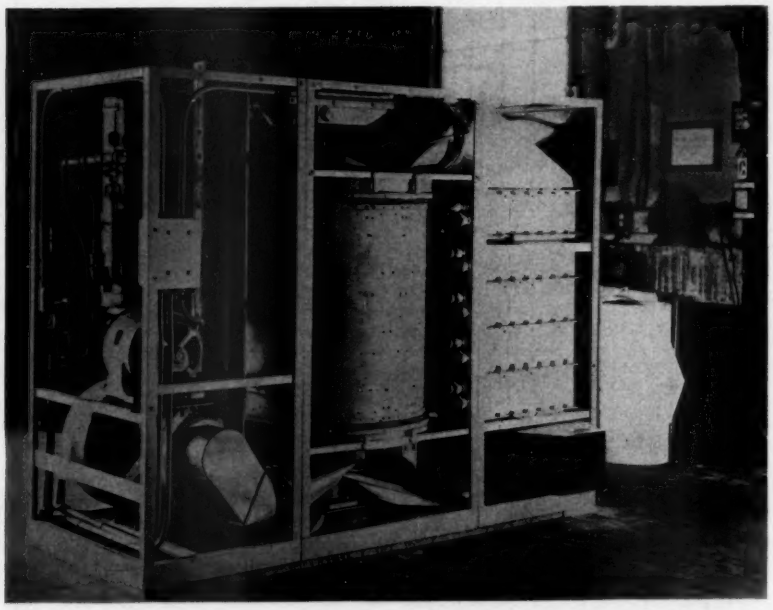
Act to Bring Gas Summer Air-Conditioning to Commercial Stage



First Assembly of Rotary Silica-Gel Residential Gas Air Conditioner

THESE dog-days are being taken advantage of by the Committee on Industrial Gas Research to conduct additional field research on gas operated summer air-conditioning apparatus. Last winter and spring, laboratory and shop work resulted in producing a radically different type of gas-fired machine suitable for residential and commercial usage. While the principles by which the air is conditioned—through the use of capillary attraction and gas heat energy—are the same as those successfully tested out last year in the Committee's field researches, the mechanical features of the machines are quite different in many ways.

The same adsorption agency (Silica Gel) is used. The chief improvement in construction, however, is in the use of a large number of gel beds, which slowly rotate once during each cycle of operation. This represents an entirely new design and is considered a distinct improvement over the design of the equipment used last summer when two large stationary gel beds were employed.

The new rotary summer air conditioners can be likened to a steam turbine whereas the former models resembled plain D slide valve engines. Thus as the series of gel beds rotate, a certain number are receiving air from which they adsorb the moisture. Other beds at the same time are receiving hot air from the gas furnace which reactivates the gel so that it will again be ready to adsorb moisture during the next revolution. Still, other beds, at the same time, are being cooled by a flow of air to remove the heat of activation. The action is continuous and results in producing a continuous flow of conditioned air. Other improvements consist of extreme compactness, resulting in considerable reduction in size and weight.

Arrangements have been made for equipping five dwellings and one small factory with the new rotary gas summer air conditioners. These are located in New York, Dallas, Chicago and Baltimore. In addition, the research 1931 residence in Chicago is being used to secure additional data. It can be seen that these cities represent strategic locations insofar as climatic conditions are concerned. Complete operating and technical data are being collected by the local cooperating gas companies. This valuable field data emanating from the various research locations is being pooled and coordinated by the Research Committee.

The following gas companies are cooperating in the air-conditioning research this summer:

Consolidated Gas Company of New York, Dallas Gas Co., Consolidated Gas, Electric Light & Power Co. of Baltimore, The Peoples Gas Light & Coke Co.

The work in Chicago is being closely followed by Dr. B. L. Rapperport, of the medical staff of the University of Illinois. Dr. Rapperport is an acknowledged authority on hay fever and similar ailments and will pay particular attention to the benefits that will accrue from properly conditioning the air in the summer.

In Baltimore, a residential size machine is being installed in a cosmetic factory to properly condition the air this summer in the portion of the factory devoted to manufacturing certain special beauty products. The residence in Baltimore is a special demonstration house erected by the Roland Park Co., real estate operators. This house will be thrown open to the public and will be extensively advertised in the newspapers and over the air.

Following the development of steam jet summer air-conditioning for railroad car service, considerable advance has been made by the Carrier Corp. in applying the principle to building air-conditioning. It is expected that a number of installations will be made before the summer is over, using gas to generate the steam. The combination of steam jet refrigeration and gas house heating promises to give a practical year 'round air-conditioning service that will be a valuable adjunct to the services the gas companies are rendering in the home.

AMERICAN GAS ASSOCIATION MONTHLY

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Volume XIV | August, 1932 | Number 8

Plan to Make A. G. A. Convention A Sign Post on Road Toward Upward Trend

By H. W. Hartman

Assistant Manager
American Gas Association

SIXTY years ago the American gas industry held its first national convention. For many years before that there had been gatherings of local managers and some state meetings, and, too, for many years there had been germinating the conception of our industry as a nation wide service. A nation wide service that should be uniform in excellence; uniform in its acceptance as an essential adjunct of the domestic and commercial development of our urban communities; uniform in its methods of distributing and selling the ideal fuel—gas.

So for many years prior to that first national convention, the pioneers of our industry were seeking a means of getting closer together, of exchanging views on policies, of establishing standards and yard sticks to guide them in the problems that beset a growing industry.

One of the first issues of the first American gas trade paper presented editorially the need for a national association. That was in 1859. From then until the first convention of the American Gas Light Association, in 1872, gas men everywhere were urging the need for some national agency for the common solution of their common problems.

Much has happened since that first national convention—including a few depressions. These depressions had different causes, varied in duration, and varied in scope, but all had one thing in common—there was no permanence about them. No matter what else the nation did about each depression, one thing it had to do and always did—it had to get over it.

No matter how dark the immediate prospect may appear, that's just what we're doing now with this latest depression—we're getting over it.

There are no standard road maps from and to depressions. The way out is recognized by most of us in retrospect. But the road out is always paved with the individual acts and reactions of all of us. The sum total of these individual endeavors must build the road, and there will be fewer detours to meet when these individual efforts are recognized in hindsight as constructive.

Our contribution as an industry cannot help but be a most potent factor in the building of that road. Our responsibility is correspondingly great. When individual effort fails, when individual courage fails, they must be reborn—pieced together through the concerted efforts of many individuals working to a common end and sustained by the faith of all.

So we must get together.

Our method of getting together has been well standardized since that first national convention. The national association has served the industry

1932 Annual Meeting Will Take Place at Atlantic City, October 10-12

through the sustained support over many years of its member companies. Its proceedings are rich in the voluntary contributions which its members have made for the common good. It is equipped through experience and member contacts to recognize and deal with the industry's problems.

Its sections, departments, staff and committees are now engaged in a cooperative effort to make the Fourteenth Annual Convention a real sign post on the road back. Sessions will begin at Atlantic City, N. J., Monday, October 10, and continue through Wednesday, October 12.

It recognizes that that road at first must be a narrow path—that economy in everything but effort must be observed. That the necessity for such economy has resulted in the temporary omission of its Annual Exhibit is a matter it deeply regrets. But recognizing this necessity it is devoting itself the more assiduously to making the business sessions of the convention of constructive aid to the members it represents.

Again, in the interest of economy, the association has shortened the period of its convention by one day. So that its members may attend at the least cost it has secured a substantial reduction in hotel rates.

The business sessions will be held in hotel meeting rooms and not at the Atlantic City Auditorium as heretofore.

A tentative schedule of general and sectional meetings and their locations is printed herewith.

While less funds have been devoted to entertainment, it will still be of a character to show the industry has not forgotten how to smile.

Tentative Convention Calendar

BELOW is an outline of the tentative calendar of events scheduled for the Fourteenth Annual Convention of the American Gas Association, which will take place at Atlantic City, N. J., October 10, 11 and 12. The main registration bureau will be located at the Traymore Hotel, with branch registration desks at Haddon Hall and the Ambassador Hotel. The program, subject to change, follows:

MONDAY, OCTOBER 10

Registration, 9:00 a.m., at:

Hotel Traymore
Haddon Hall
Hotel Ambassador

Exhibit of Office Labor Saving Devices	10:00 a.m.—Haddon Hall
Natural Gas Department Session	2:00 p.m.—Ambassador
First Accounting Section Session	2:00 p.m.—Haddon Hall
Publicity and Advertising Section Session	3:00 p.m.—Ambassador
First General Session	8:00 p.m.—Traymore
Entertainment	10:30 p.m.—Traymore

TUESDAY, OCTOBER 11

Registration, 9:00 a.m., at:

Hotel Traymore
Haddon Hall
Hotel Ambassador

Second General Session	10:00 a.m.—Traymore
Second Accounting Section Session	2:00 p.m.—Haddon Hall
First Commercial Section Session	2:00 p.m.—Traymore
First Industrial Gas Section Session	2:00 p.m.—Traymore
First Technical Section Session	2:00 p.m.—Ambassador
Entertainment	8:00 p.m.—Traymore

WEDNESDAY, OCTOBER 12

Registration, 9:00 a.m., at:

Hotel Traymore
Hotel Ambassador

Third General Session	10:00 a.m.—Traymore
Second Commercial Section Session	2:00 p.m.—Traymore
Second Industrial Gas Section Session	2:00 p.m.—Traymore
Second Technical Section Session	2:00 p.m.—Ambassador

However, none of these concessions to economy will be permitted to weaken the effectiveness of the convention. Full opportunity will be afforded to make it a real exposition of the present status of the industry—an inventory of the many sources of strength and stability that have carried it triumphant through so many former periods of stress.

National problems collateral to the welfare of the industry will be the subject of addresses by speakers of national importance.

The programs of the sections and departments will reflect the latest developments in their respective branches of the industry.

Accounting Section

The Accounting Section's Committee on Mechanical Office Equipment will present a report replete in possible economies in billing procedures, "wrinkles," and shortcuts that save the pennies which, added together, make big savings in operation.

That difficult subject of "Collections" will be thoroughly discussed.

"Customer Relations as Affected by Change to Mixed Gases" will be a most timely subject for companies that may soon have to meet this problem.

An exhibit of office labor-saving devices will be given in conjunction with the Accounting Section sessions at Haddon Hall.

The Commercial Section

"Competition and What to Do About It" will be the general theme of two meetings to be held by the Commercial Section. Both sessions will take place in the Rose Room at the Traymore; the first at 2 p.m., Monday, October 10, and the second the following day at the same hour.

(Continued on page 364)

Master Plumbers Find Cooperative Merchandising Plan Success in First Year

MANUFACTURERS of gas appliances displayed all of their finest and newest products at the Golden Anniversary Exposition of the National Association of Master Plumbers, which took place June 20-23 at Madison Square Garden, New York. In addition there was a cooperative exhibit sponsored by the Consolidated Gas Company of New York, The Brooklyn Union Gas Company, Public Service Electric and Gas Company, Kings County Gas Company, New York & Richmond Gas Company, Brooklyn Borough Gas Co., and the American Gas Association. In all, 103 exhibitors maintained displays throughout the exposition, which was attended by 65,000 visitors.

Manufacturer company members of the American Gas Association who were among the exhibitors follow:

The American Brass Company, Waterbury, Conn.; American Radiator Company, New York; American Stove Company, Long Island City, N. Y.; The Central Foundry Company, New York; Crane Co., Chicago, Ill.; Electrolux Refrigerator Sales, Inc., New York; Faraday Refrigerator Corporation, Dayton, Ohio; Hardwick Stove Company, Brooklyn, N. Y.; Hoffman Specialty Co., Inc., Waterbury, Conn.; The Hotstream Heater Company, Cleveland, Ohio; The Imperial Brass Manufacturing Company, Chicago, Ill.; Johns-Manville Corporation, New York; John G. Kelly, Inc., New York; The Kompak Company, New Brunswick, N. J.; McDonnell and Miller, Chicago, Ill.; Mueller Co., Decatur, Ill.; National Tube Company, Pittsburgh, Pa.; Republic Steel Corporation, Youngstown, Ohio; Roberts & Mander Stove Company, Philadelphia, Pa.; Ruud Manufacturing Company, Pittsburgh, Pa.; Standard Gas Equipment Corporation, New York; and The Youngstown Sheet and Tube Co., Youngstown, Ohio.

American Gas Association Exhibit at Exposition of National Association of Master Plumbers

Oscar H. Fogg Tells National Organization Movement Has Led to Better Understanding with Gas Companies

Reports of exhibitors interviewed during and after the exposition were unexpectedly optimistic. Many consumer contacts, for follow-up later, were developed, which showed that most of the exhibitors unfolded sufficient business on the floor of the show to defray the cost of their attractive displays. The general response to the opportunities afforded was regarded as unexpectedly favorable, a fact which was particularly pleasant to the Plumbers' Association and the sponsors of the cooperative gas exhibit.

While the exposition was in progress, the plumbers held their annual convention. One of the high spots of this was the adoption of a resolution directing the board of directors to take steps to secure relief from unethical, profit-destroying wholesaler practices. It was resolved that the distribution of air conditioning materials should be through the plumbing and heating trade. The board also was instructed to work out a new plan for the reimbursement of contractors on installation costs of defectively manufactured sanitary ware. A uniform code, to be sponsored by the national association, was recommended.

One of the outstanding features of the convention was the fact that the temper of the master plumbers indicated that cooperative merchandising plans agreed upon between gas companies, led by the American Gas Association, and the National Association of Master Plumbers, have worked out successfully during the first year of intensive application. Jere L. Murphy, chairman of the N. A. M. P. Special Committee, told the convention that

the twelve-month trial had indicated that the cooperative merchandising plan had proved equitable. Colonel Oscar H. Fogg, vice-president of the Consolidated Gas Company of New York and chairman of the A. G. A. Committee on Allied Trades, declared that a constantly increasing number of contractor dealers and public utility companies are accepting the cooperative plan and placing it in satisfactory practice.

Col. Fogg said:

Oscar H. Fogg

"For the last two years or thereabouts, I have had the privilege of serving as chairman of the Committee on Allied Trades of the American Gas Association. It was this committee which formulated the trade principles presented to you a year ago by Mr. Hugh Cuthrell, in the course of his address at your Milwaukee convention. As he explained at that time, the principles were intended to provide a sound basis for the development of cooperative trade relations, and our experience justifies the belief that they are successfully accomplishing that purpose. Few things move as speedily as we might wish. All improvements must overcome a certain amount of inertia and sometimes active opposition. You gentlemen have had that experience in your own affairs—we have had it in ours. There may be some in this gathering who are dissatisfied with the progress that has been made, or the lack of any progress, in their own localities. We have within our own ranks some who have a somewhat similar feeling, but on the other hand there are many in both groups who can testify that the movement toward sound cooperative trade relationship between your industry and ours is going steadily forward.

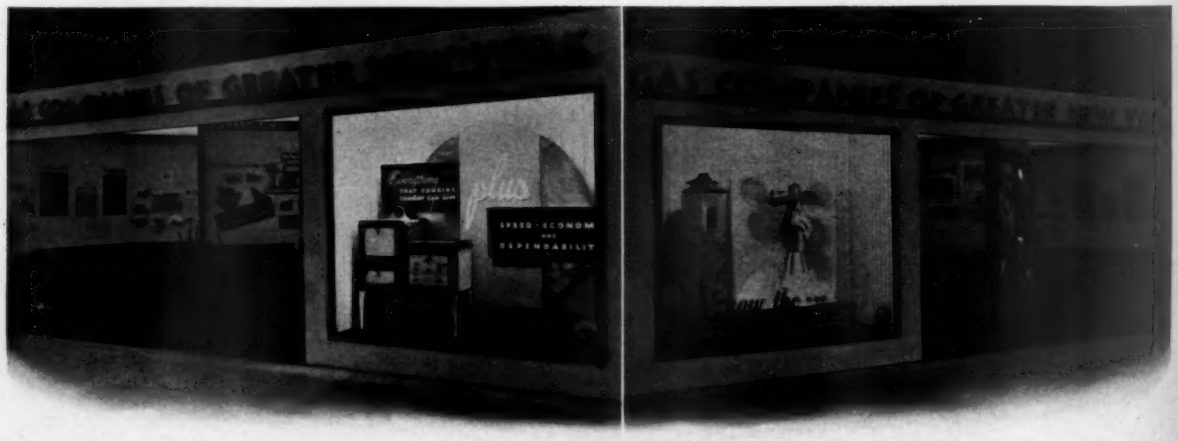
"With that as a sort of preamble, I think it may be well for me to outline briefly the recent activities of the American Gas Association looking toward the continued development of cooperative sales activities between its companies and members of your association. I know no more important responsibility of a business organization —and especially of a public utility— than that of having a clear understanding of business relations with the owners of other businesses, which may to some extent be operating in a similar field of activity.

"Although the efforts of the American Gas Association have been directed toward this end for a period of years, in the interest of brevity I recount only the developments of the last twelve months, as an indication of the results that are being realized.

"As I have already mentioned, at the last convention of your association, the chairman of our Trade and Dealer Cooperation Committee, Hugh Cuthrell, of the Brooklyn Union Gas Company, was privileged to present to you the principles to which I have referred, and we were gratified to have your association approve them as the best basis for the development of mutually satisfactory trade relations.

"In presenting these recommendations to your last convention, Mr. Cuthrell also offered the good offices and assistance of the American Gas Association in bringing about the desired relations in any localities where special situations arose, provided the complaints of your members were forwarded to the American Gas Association through your own national association. Since that time some complaints have been brought to the headquarters of the Gas Association and it is gratifying to report that in every instance the gas utilities have given the fullest cooperation in improving their relations with plumbing dealers, with the result that in practically every case misunderstandings have been dissolved and matters have been settled satisfactorily.

"These principles, representing the official policy of the gas industry of America, were broadcast to our member companies on June 19, 1931, and received similar distribution to the members of your association shortly after their approval at your last convention. During the Fall of 1931 the Gas Association made a survey of the extent to which gas companies had accepted these principles as a guide in conducting their local appliance merchandise and promotional activities. It was found that gas companies serving approximately five million customers had done so.



Cooperative Exhibit sponsored by New York Gas Companies at Exposition of National Association of Master Plumbers

"A second survey was made during the past month, and while not yet complete, it shows that approximately 200 gas companies serving seven million customers, or more, are actively engaged in furthering the dealer cooperation movement, as recommended by the American Gas Association. Supplementing these expressions of approval on the part of member gas companies, a number of state utility associations have, by formal resolution, adopted these principles and have inaugurated cooperative state movements by utilities and dealer groups in their respective territories. From long familiarity in this field, I believe and I am sure you will agree with me, that these results within the span of one year represent distinct progress in a movement so fundamental in character and so subject to the human equation factor as this one is.

"As with all progressive movements, ideas and recommendations of this kind take root more promptly and more firmly in some sections of the country than in others. Some gas companies and plumbing dealers were already following these principles prior to their adoption by the American Gas Association and their approval by your association. Many companies and dealers can immediately see the value of a project of this kind, while others must be shown by experience elsewhere before taking action. No movement of such scope can expect the fullest acceptance overnight and the ever-growing approval indicated by the present survey means that further progress will be easier and more effective in the solution of this problem.

"I would ask you to remember that while the sale of gas appliances represents to your members only a part of your entire business activities, to the gas industry it represents the life blood of its growth and the keystone of its future development. Gas cannot be delivered to the customer's back door like other commodities. The value of our product to the customer is entirely dependent upon the ability of the equipment to render satisfactory service and to provide comfort and convenience to the consumer. Customer satisfaction cannot be assured nor can the utility's desire to increase gas sales in the future or protect its present sales be achieved except by assuring a satisfactory number and quality of appliances on its lines. It is easy to see, therefore, why the gas companies feel that they must exercise leadership in the appliance selling business by furthering the sale of approved appliances and encouraging the activities of dealers in the markets created as a result of these promotional activities by the company. Intelligent estimates indicate that throughout the country as a whole less than half of all the gas appliances sold are handled by gas companies, the remainder being sold by dealers. The gas industry's continued leadership in merchandise activities has resulted in direct benefits to the dealers by building up the market for them.

"In some quarters the demand has arisen that the utilities confine their efforts entirely to the work of advertising, soliciting, and stimulating the public desire for gas service, leaving it thereafter to the local dealers to furnish the necessary appliances. In two states laws to this effect have been in force during the past year. Particularly under recent business conditions, it was not unnatural that the dealers should feel that the retirement of the utility from the appliance field would give them a corresponding increase at a time when most urgently needed. But has that been the case? Apparently not, for while complete statistics are not available there have been no reports from these states that would indicate that the business formerly done by the utility companies has been transferred in any large quantity to the local dealers. Instead, our information is that local sales have been curtailed, to the disadvantage of the dealers and the companies alike—apparently the mail order houses have been the only ones to benefit. Certainly the business of the community has not been helped. While it is impossible to predict the outcome in these states, it seems certain that if the matter is carefully reconsidered by all parties in the light of their own interests, such legislative mistakes cannot help being corrected.

"The truth of the matter is that gas service is in active competition with all sorts of other home services such as oil, coal, wood and electricity, each striving for its share of the customer's dollar, and that the agencies in a position to profit from the sale of gas and gas appliances are not so much in competition with each other as they are commonly interested in the promotion of the use of gas to the benefit of all. The active and reputable dealer needs the support of the gas company in promoting the use of gas in his locality and in establishing the market for satisfactory gas appliances by selling such, and the gas company needs the support of these dealers as a part of the army campaigning for the greater use of gas in the home. I feel that the growing recognition of these common interests by members of your industry and ours is one of the brightest indications of the possibilities for the future development of our business and yours.

"It is difficult to conceive of a period in our business history when greater need was apparent for wholehearted cooperation between allied industries than there is at the present time. That we are realizing that fact is shown, I think, by the exhibition which is being held in conjunction with your convention. There you will find a display sponsored jointly by the American Gas Association and the gas companies in this metropolitan area. It is a striking indication of how gas companies and their national Association are cooperating with the plumbing trade. The display also endeavors to show more clearly what the approval of the American Gas Association Laboratory represents, and why dealers should limit their sales to approved appliances. Incidentally, I believe you will find in this exhibit a greater participation on the part of gas appliance manufacturers than you have found at any previous exhibit. I mention this because I believe it indicates that cooperation between the gas company and plumbers has likewise resulted in a better understanding between gas appliance manufacturers and the plumbing trade. The years immediately ahead are likely to be busy ones for all of us. I am no prophet, and so I am not predicting any definite date for a general business revival, but I can tell you that the manufacturers of gas appliances have formulated plans to underwrite a three-year campaign of national advertising, and if they succeed in what they have set out to

(Continued on page 364)

Local Companies Aid National Contest to Help House Heating Sales

A LETTER-WRITING contest to induce more people to think about gas heating, which is made a part of the current advertising campaign of the Surface Combustion Corporation, Toledo, Ohio, functioning in cooperation with many gas companies, is meeting with generous and enthusiastic response, according to D. H. Bacon, advertising manager of the sponsor.

For the best letters of 200 words or less on "Why I Want Automatic Gas Heating in My Home," the company is offering a Heatmaster Model K Furnace, installed free and the first season's gas cost paid; a Heatmaster Model F Furnace, installed free; and three Janitrols, installed free, explained Mr. Bacon.

Since the rules of the contest include the statement "Prize winners must agree that the furnace will be installed in their present home," only actual prospects will be interested.

In addition to the national prizes, several gas companies are offering Janitrols as first prizes for the best letters in their own territories. One company in the middle west has even offered a Heatmaster Model K for first local prize and a Janitrol for second local prize. Another gas company that sells house heating plants only through dealers is offering three Janitrols locally through these dealers and has arranged with a local firm to tie in and make the installations free.

With requests for permission to conduct a local contest and offer a local prize still coming in, it is impossible at this time to estimate how many local contests will be run.

Before the contest announcement broadside to the gas companies was off the presses, Surface Combustion executives had outlined the contest plan to several utility executives. Realizing the possibilities of running a local contest at the same time as the national contest, they asked permission to help work out the details.

The Memphis Power & Light Company, Memphis, Tenn., was among the first companies attempting to stimulate local interest in the national contest by offering a prize to the person writing the best letter from Memphis. That concern is conducting a comprehensive advertising campaign in its territory.

A special poster had to be prepared for the contest announcement broadside, describing the plans to tie

2 WAYS TO HEAT A HOME
Which do you prefer?
This man does no furnace tending whatever—yet his home is always comfortably warm. The air he breathes indoors is gently circulated to every room in the house. It is thoroughly cleaned, humidified, uniform in temperature and healthful. He never has to bother ordering fuel or storing it. He does no furnace stoking. He comes and goes as he pleases without a thought about the furnace fire. There's a Heatmaster Gas-Fired Warm Air Furnace in his basement—that's why!
This man actually puts in hours every week tending a furnace. He's up long before dawn in the winter, to feed the furnace its daily ration. He or his wife fumes and fusses with it two or three times a day. Even so, his home is not always comfortable. It's often stuffy, or even chilly. The air is dried out, depressing, full of potential doctor bills—all because he's struggling with an ordinary furnace in his basement. Yet the very gas pipe he passes on the way to his stoking job, can easily be his fuel supply for heating—forever banishing furnace drudgery from his life
RULES
No entry blanks required. Write in 200 words or less, the reasons why you would like to have automatic gas heating in your home. Awards will be made on most convincing reasons given. Tell the kind of heating system you now have—warm air, steam, hot water, etc., the kind of fuel you burn, the number of rooms to be heated and whether you rent or own your home. Letters must be mailed by September 15, 1932.
Contest open to everyone, except employees of this company and gas companies. Prize winners must agree that furnaces will be installed in present home. In the event of a tie duplicate prizes will be awarded. Mail your letter to Contest Judges, c/o Surface Combustion Corporation, 2376 Dorr St., Toledo, Ohio.
• PRIZES •
FIRST PRIZE—a fully Automatic Gas-Fired Heatmaster (Model K) Warm Air Furnace, plus your gas bill paid for first season's heating cost. It is the last word in efficiency—providing constant circulation of cleaned, healthful warm air. Eliminates furnace tending.
SECOND PRIZE—a fully Automatic Gas-Fired Heatmaster Warm Air Furnace. It will supply your home with cleaned, healthful, humidified air gently circulated to every room in the house. Light it in October—forget it until May
THREE OTHER PRIZES—a Heatmaster Janitrol which transforms any steam, hot water, vapor, or warm air furnace into a completely automatic gas-fired heating system, will be awarded each of the writers of the next three prize winning letters. Over 50,000 satisfied users.
HEATMASTER
GAS HEATING EQUIPMENT
Free FURNACE FOR YOUR HOME
and gas cost paid for season
DO you want to get rid of furnace tending? Here's your chance!
You may win a new Heatmaster Gas-Fired Warm Air Furnace for your home, with fuel cost paid for first season's heating. Or one of the other prizes.
Here's how—write a letter (200 words or less)—telling—"Why I want automatic gas heating in my home!" It's easy—there are so many things to write about. Tell about labor saving, convenience, no fuel to store, no furnace tending, uniformity of temperature—or any of a dozen advantages.
We suggest that you talk to your gas company house heating department. Ask them for suggestions. You may get from them just the ideas you need to win. Send in your letter today.
a product of Surface Combustion Corporation

Advertisement announcing Surface Combustion Corporation's letter-writing contest

up with local gas companies who offer prizes to their own gas customers.

Three contest advertisements are appearing in national magazines, *House Beautiful, Literary Digest, Better Homes and Gardens* and *Time,* which reach over 3,000,000 gas users.

In the first advertisement in the series, headed "Two ways to heat a home. Which do you prefer?" automatic gas heating is compared with the old-fashioned furnace tending. Even the illustrations drive home the great improvement over stoking in a dingy basement. "Do you want to get rid of furnace tending?" starts the contest copy. "Here's your chance."

After outlining the contest the advertisement concludes:

"We suggest that you talk to your gas company house heating department. Ask them for suggestions. You may get from them just the ideas you need to win. Send in your letter today."

Much of the promotion material for the local gas companies is being donated by Surface Combustion. It is offering 2,000 large two-color consumer broadsides to the gas companies which will mail them to their customers. These are imprinted with the name and address of the gas company.

To the gas companies that tie in by offering a local prize, Surface Combustion gives 5,000 consumer broadsides with a special imprint of the local offer, a description of the local prize and complete contest details. On the inside spread of all the consumer broadsides is an enlargement of the first contest advertisement, which is reproduced herewith.

Following is a list of companies entering upon local contests:

Fremont Gas Co., Fremont, Nebr.; Manufacturers Light & Heat Co., Pittsburgh, Pa.; Lone Star Gas Co., Fort Worth, Texas; Hornell Gas Light Co., Hornell, N. Y.; Missouri Power & Light Co., Kansas City, Mo.; Pawtucket Gas Co., Pawtucket, R. I.; Public Service Co. of Colorado, Denver, Colo.; Memphis Power & Light Co., Memphis, Tenn.; West Ohio Public Service Co., Greenville, Ohio; Utah Gas & Coke Co., Salt Lake City, Utah; Wasatch Gas Co., Provo, Utah; Ogden Gas Co., Ogden, Utah; Minnesota Northern Power Co., Minneapolis, Minn.; Union Gas & Electric Co., Cincinnati, Ohio; Dallas Gas Co., Dallas, Texas.

The LaClede Gas Light Co., St. Louis, Mo.; Lake Shore Gas Co., Ashtabula, Ohio; Elmira Light, Heat & Power Corp., Elmira, N. Y.; St. Louis County Gas Co., Webster Groves, Mo.; Natural Gas Division, Montana Power Co., Butte, Mont.; Sioux Falls Gas Co., Sioux Falls, S. D.; Minneapolis Gas Light Co., Minneapolis, Minn.; City Light & Traction Co., Sedalia, Mo.; Birmingham Gas Co., Birmingham, Ala.; Fort Dodge Gas & Electric Co., Ft. Dodge, Iowa; Manson Light & Power Co., Manson, Iowa; Gas Corporation of Michigan, Mt. Pleasant, Mich.; Watts Utility Co., Richmond, Va.; Central Kentucky Natural Gas Co., Lexington, Ky.; Peoples Gas & Electric Co., Mason City, Iowa.

Equitable Gas Co., Pittsburgh, Pa.; Elizabethtown Consolidated Gas Co., Westfield, N. J.; Owensboro Gas Co., Owensboro, Ky.; Montana Power Co., Butte, Mont.; Minneapolis Gas Light Co., Minneapolis, Minn.; Public Utilities Con. Corporation, LaJunta, Colo.; Gas & Electric Appliance, Mt. Vernon, Ohio; Pittsfield Coal Gas Co., Pittsfield, Mass.; Battle Creek Gas Co., Battle Creek, Mich.; Concord Gas Co., Concord, N. H.; Wisconsin Gas & Electric Co., Racine, Wis.; Wisconsin Gas & Electric Co., Kenosha, Wis.; City of Ypsilanti—Gas Department, Ypsilanti, Mich.; Indiana Gas Utilities Co., Terre Haute, Ind.; Acme Heating Co., Cincinnati, Ohio; San Antonio Public Service Co., San Antonio, Texas; Texas Public Service Co., Austin, Texas; Georgia Natural Gas Corporation, Milledgeville, Ga.; Illinois Power & Light Co., Danville, Ill.; Tri-City Gas Co., Gadsden, Ala.; Wisconsin Fuel & Light Co., Manitowoc, Wis.

Gas & Electric Shop, Dayton, Ohio; Des Moines Gas Co., Des Moines, Iowa; Fall River Gas Works Co., Fall River, Mass.; New Bedford Gas & Electric Light Co., New Bedford, Mass.; Manchester Gas Co., Manchester, N. H.; Long Island Lighting Co., Bay Shore, N. Y.; Southern Cities Distr. Co., Shreveport, La.; Portsmouth Gas Co., Portsmouth, Ohio; Old Colony Gas Co., Braintree, Mass.; Henderson & Oxford Gas Co., Henderson, N. C.; Citizens Gas Co., Calais, Me.; Central Hudson Gas & Electric Corp., Albany, N. Y.; Boston Consolidated Gas Co., Boston, Mass.; Mannen & Roth Co., Cleveland, Ohio; Detroit City Gas Co., Detroit, Mich.; Citizens Gas Co., Indianapolis, Ind.; Peoples Gas Co., Glassboro, N. J.

Southern Natural Gas Corp., Birmingham, Ala.; North Shore Gas Co., Waukegan, Ill.; The Sioux City Gas & Electric Co., Sioux City, Iowa; North Central Gas Co., Bayard, Nebr.; New York & Richmond Gas Co., Staten Island, N. Y.; Jersey Central Power & Light Co., Asbury Park, N. J.; New Jersey Northern Gas Co., Flemington, N. J.; Metropolitan Edison Co., Easton, Pa.; New Jersey Power & Light Co., Phillipsburgh, N. J.; North Central Gas Co., Scottsbluff, Nebr.; Ottawa Gas Co., Ottawa, Canada.; Jaminson McKinney Co., Inc., Ithaca, N. Y.; Consumers Gas Co., Reading, Pa.; Louisiana Public Utilities Co., Lafayette, La.; New York State Electric & Gas Corp., Lockport, N. Y.; Dean & Day, Tulsa, Okla.; West Tennessee Power & Light Co., Jackson, Tenn.

Milwaukee Gas Light Co., Milwaukee, Wis.; Western United Gas & Elec. Co., Aurora, Ill.; Illinois Power & Light Corp., East St. Louis, Ill.; Lynn Gas & Electric Co., Lynn, Mass.; Binghamton Gas Works, Binghamton, N. Y.; North Central Gas Co., Morrill, Nebr.; Philadelphia Gas Works Co., Philadelphia, Pa.; Cambridge Gas Light Co., Cambridge, Mass.; Worcester Gas Light Co., Worcester, Mass.; New Bedford Gas & Edison Light Co., New Bedford, Mass.; Public Service Electric & Gas Co., Newark, N. J.; Citizens Gas Company, Stroudsburg, Pa.; Bangor Gas Company, Bangor, Pa.

County Gas Company, Atlantic Highlands, N. J.; Iowa Gas Distrib-

(Continued on page 364)

Behavior of Steel at Forging Temperatures With Respect to Scaling Losses

By DONALD W. MURPHY*

THE scaling of steel, that is, its oxidation at elevated temperatures, is a more serious problem than is often appreciated. In the past it has been regarded as a necessary evil and so dismissed with little further thought.

The economic loss actually entailed as a consequence of scaling may be realized by reference to Table I. This table is based on the results of the research reported in this paper applied to steel produced in the mill and to the steel used in forging for the years 1929 and 1931.

It will be seen that for the peak year, 1929, the losses in the steel mill occurring during the soaking heat prior to rolling might easily amount to 344,000,000 to 545,000,000 pounds representing values from $830,000 to $1,310,000. Even during 1929, these losses quite probably amounted to 157,000,000 to 250,000,000 pounds of metal having an intrinsic value of $326,000 to $520,000. In the forging industry alone the losses ranged from 9,150,000 to 14,000,000 pounds for 1929, an economic loss of $220,000 to $352,000, while for the year 1931, the loss of metal quite probably ranged from 3,380,000 to 5,390,000 pounds having a value of $70,000 to $112,000. These figures will serve to indicate the magnitude and value of the amount of metal lost.

The intrinsic value of the metal lost, is however, only one of the detriments of excessive scaling. Scale reacts with most furnace refractories to form a relatively low melting compound which may greatly shorten the life of the furnace. Scale also occupies space in forging dies and may easily result in wrongly dimensioned parts. Should it be pounded or rolled into the metal surface, imperfections result which may lead to failure of the forging or rejection of the steel. Finally, the removal of scale in the finishing operation naturally involves additional labor and equipment costs which increase with the depth and adherence of the scale. It seems evident that this problem of oxidation of steel entails a total cost to the producer considerably in excess of the intrinsic value of the metal lost, a cost which is influenced by factors whose magnitude it is exceedingly difficult to estimate.

TABLE I
Partial Estimates of Scaling Losses in Industry

	Condition of Atmosphere	Losses Based on 1929 Production		Losses Based on 1931 Production	
		Lbs. Metal	Value in Dollars	Lbs. Metal	Value in Dollars
Losses in steel mill one heating at 2300° F.	4%O_2	419,000,000	1,010,000	192,000,000	398,000
	1%O_2	388,000,000	935,000	178,000,000	370,000
	2%CO	344,000,000	830,000	157,000,000	326,000
Losses in steel mill one heating at 2400° F.	4%O_2	545,000,000	1,310,000	250,000,000	520,000
	2%CO	449,000,000	1,200,000	205,000,000	425,000
Losses in steel forged one heating at 2300° F.	4%O_2	11,100,000	268,000	4,100,000	85,000
	1%O_2	10,300,000	248,000	3,820,000	79,200
	2%CO	9,150,000	220,000	3,380,000	70,000
Losses in steel forged one heating at 2400° F.	4%O_2	14,600,000	352,000	5,390,000	112,000
	2%CO	12,000,000	289,000	4,400,000	91,100

From the table it is also evident that both atmosphere and temperature have an important effect on scaling losses. The composition of the atmosphere in the furnace must, therefore, be subject to accurate control. In this respect gas is especially satisfactory. Since it is the most highly refined fuel, the control of the composition of atmospheres formed by burning it with air is more easily effected than with other fuels. Gas heat has, to be sure, other inherent advantages from the point of view of speed and economy. In many applications the high rates of heating capable of attainment in the gas-fired furnace are of considerable advantage in shortening heating times and thus increasing furnace capacity. Gas is also a very economical fuel when used intelligently in furnaces of proper design, but its most important claim for consideration in heating furnaces lies in the fact that with gas heat, it is relatively easy to control the atmosphere and temperature.

The importance of this problem of scaling and the fact that information regarding it was so limited prompted the Committee on Industrial Gas Research of the American Gas Associa-

* Dr. Murphy is A. G. A. research fellow in metallurgy at the University of Michigan. He presented this paper at the June Convention of the American Institute of Iron and Steel Electrical Engineers in Pittsburgh, Pa. The subject matter is a result of some of the work which Dr. Murphy has carried on for the A. G. A. Committee on Industrial Gas Research in the application of gas heat to forging and heat treating of steel.

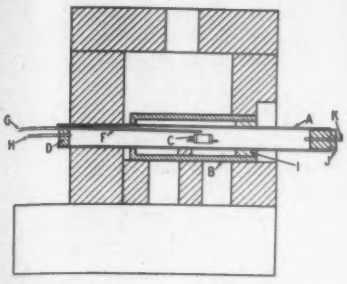

A - Porcelain tube
B - Carborundum muffle
C - Sample
D - Fire brick plug
F - Thermocouple protection tube
Thermocouple inside
G - Thermocouple leads
H - Air inlet from flow meter
I - Front muffle brick
J - Brick to close tube
K - Gas sampling tube to siphon sampler

FIG. 1 GAS FURNACE USED IN SCALING TESTS

tion, about three years ago, to institute and carry on a program of scaling research at the University of Michigan. It was realized that an accurate knowledge of how metals will behave under any given conditions of operation is essential to the proper design and operation of a furnace for metallurgical application. This paper presents the results of that research.

The method of investigation used consisted essentially in exposing small steel samples to the action of the chosen atmosphere under the desired conditions of velocity and temperature for given periods of time, quenching, stripping, and determining the loss in weight. The samples were heated in the small gas-fired furnace shown in Figure I, which had an outer carborundum muffle and a porcelain tube as an inner muffle. The porcelain tube was used in order that the furnace atmosphere might not interfere with the study of the isolated factors. The composition of the various steels studied is given in Table II.

The Scaling of Steel in Simple Gases

The object of studying the scaling of steel in simple gases was to evaluate the fundamental laws governing the process. The oxidation of steel is essentially a surface reaction; it would therefore be expected that scaling losses for any given steel would be a function of the area of metal exposed. The truth of this assumption is borne out by the figures of Table III which summarize the results of tests on various sizes of S.A.E. 1015 steel at 2300° F. in dry air. The percentage loss in weight increases with decreasing size of sample, but when the loss is expressed in terms of weight per unit area, these differences between samples of varying size disappear. All results are, for this reason, expressed in terms of weight per unit area, the unit of area being chosen as 100 square inches.

The effect of varying the velocity of the gas stream on the scaling of S.A.E. 1015 steel at 2300° F. is shown in Figure 2. In each case the data indicate that, beginning with rates of flow in the neighborhood of zero feet per minute, there is a rapid increase in scaling losses with increasing velocity. There seems to be, however, a critical rate of supply of the oxidizing gas beyond which an increase in the velocity of the gas has no effect, as is shown in the flat portion of the curves. In the case of water vapor the effect of increasing the velocity is more gradual than in either of the other two cases.

Figure 3 shows the effect of varying the time of exposure of S.A.E. 1015 steel at 2300° F. The scaling losses follow a smooth curve, increasing with increasing time. The form of these curves indicates, however, that the rate of scaling diminishes with increasing time, because of the increasing thickness of scale. The increasing thickness of scale operates to reduce continually the amount of oxidizing agent diffusing inward toward the metal. Consequently, since the supply diminishes steadily, the rate of scaling or formation of new oxides must also diminish.

When the temperature to which the steel is exposed is increased, the scaling losses mount rapidly as is shown in Figure 4. Furthermore, it is strikingly evident that the curves, with the exception of that for oxygen, change direction very rapidly between 2400° F. and 2500° F. This very marked increase in scaling losses is accounted for by the fact that in this temperature range the scale becomes liquid and consequently fails in its protective action. The case of oxygen is somewhat different since here the marked increase in scaling occurs at 2375° F. At this temperature the heat developed by the oxidizing reaction raises the actual temperature of the sample so rapidly that the reaction becomes increasingly vigorous, and culminates in the complete burning of the steel to form oxide.

If the partial pressure of the oxidizing gas in mixtures with nitrogen is increased, the scaling losses increase in regular fashion as shown in Figure 5. This result is to be expected, since the greater the partial pressure of the gas the greater the supply of oxidizing agent. This enables more metal to

TABLE II
Chemical Composition of the Steels

Steel	*%C*	*%Mn*	*%Si*	*%S*	*%P*	*%Ni*	*%Cr*	*%Va*	*%Mo*	*%W*
Elec. Iron	.012	.008	.001	.007	.002	—	—	—	—	—
1015	.19	.53	.18	.020	.016	—	—	—	—	—
1030	.28	.653	.01	.032	.013	—	—	—	—	—
1050	.52	.64	—	.034	.025	—	—	—	—	—
1090	.88	.34	—	.018	.029	—	—	—	—	—
High C Tool	1.12	.33	.21	.026	.011	—	—	—	—	—
2320	.17	.59	.24	.020	.018	3.40	—	—	—	—
3130	.35	.56	—	.025	.016	1.11	.56	—	—	—
6145	.47	.58	.16	.015	.015	—	.98	.24	—	—
4140	.39	.67	—	.024	.020	—	.93	—	.32	—
4615	.21	.54	.29	.012	.017	1.81	—	—	.25	—
High Speed	.73	.32	.08	.018	.025	—	4.27	1.06	—	18.62
Krupp KA2	.12	.45	.25	.03 max.	.03 max.	4.00	1.50	—	—	—
	.08	—	—	—	—	9.00	17.50	—	—	—
Nitralloy	.35	.45	.30 max.	.025 max.	.025 max.	—	1.25	—	.20	1.00 Al

TABLE III

Effect of Variation of the Size of Sample on Scaling of S.A.E. 1015 Steel in Dry Air at 2300° F.

Sample Number	Total Time in Furnace (Minutes)	Rate of Flow Ft. Per Minute	Diameter of Sample (Inches)	% Loss in Weight	Loss in Lbs. Per 100 Sq.In.	Wt. of Scale Lbs. Per 100 Sq.In.	Av. Loss in Wt. / Av. Wt. of Scale
AR7	40	60	.500	7.96	.123	.171	
AR8	40	60	.500	7.58	.118	.166	
Average				7.77	.121	.169	.715
AR9	40	60	.375	9.65	.115	.169	
AR10	40	60	.375	9.99	.123	—	
Average				9.82	.119	.169	.709
AR11	40	60	.6197	6.86	.129	.180	
AR12	40	60	.6230	6.66	.126	.174	
Average			.6214	6.76	.127	.177	.719
630	40	60	.8138	4.88	.118	.163	
646	40	60	.8135	5.18	.122	.169	
Average			.8136	5.03	.120	.166	.720

enter the reaction in much the same fashion as was found when the velocity was increased.

In the forging range of temperatures, 2000° F. to 2500° F., this investigation has shown that steam is the most active scaling agent, while carbon dioxide and air are approximately the same in scaling power. Oxygen does not exceed pure steam in effect until 2375° F. is reached, at which point the oxygen reaction is markedly accelerated.

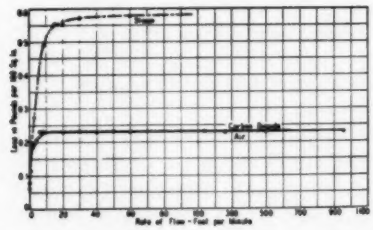


FIG. 2 EFFECT OF VARIATION OF RATE OF FLOW ON THE SCALING OF S.A.E. 1015 STEEL AT 2300° F

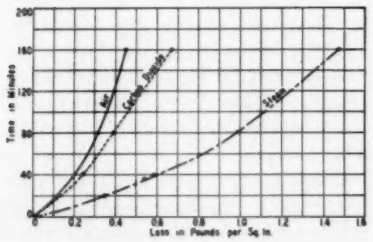


FIG. 3 EFFECT OF VARIATION OF TIME ON THE SCALING OF S.A.E. STEEL AT 2300° F

The fundamental laws resulting from this study might be briefly summarized as follows: First, scaling losses are, at least in most cases, strictly a function of area exposed. Second, scaling losses are increased by increasing the velocity of gas, but attain a constant value for velocities of 10 or 20 feet per minute and higher. Third, scaling increases with increasing time, but does so at a diminishing rate. Fourth, oxidation increases with increasing temperature, and becomes very great when the melting point of the oxides, about 2480° F. is exceeded. Fifth, scaling losses increase with increasing partial pressure of the oxidizing gas.

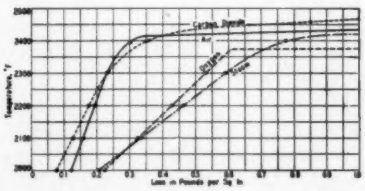


FIG. 4 EFFECT OF VARIATION OF TEMPERATURE ON THE SCALING OF S.A.E. 1015 STEEL

Oxidation Equilibria

The oxidation equilibria chiefly involved in the scaling of steel in furnace atmospheres are $Fe + H_2O = FeO + H_2$ and $Fe + CO_2 = FeO + CO$. In this investigation of these equilibria above 2000° F., the amount of scaling produced by any given mixture of hydrogen and water vapor, or of carbon monoxide and dioxide was of no import, since the only knowledge required of any particular mixture was whether or not it produced scaling at the temperature in question. Hence a series of tests were made at various temperatures at 2300° F. for example with mixtures of hydrogen and water vapor containing various amounts of water vapor. These mixtures were designated as scaling or non-scaling, depending upon their reaction upon iron. The limits between the lowest scaling and highest non-scaling mixtures were from 0.4 per cent to 2.0 per cent of water vapor. This procedure was repeated at several temperatures between 2000° F. and 2600° F. The results are plotted in Figure 6, in which the upper portion of the curve is so drawn that it lies at each of the chosen temperatures between the closest scaling and non-scaling compositions. The lower portion of the curve is due to Emmett and Schultz.[1]

Much the same procedure was followed where iron was exposed to mixtures of carbon dioxide and carbon monoxide. The results of this study are shown in Figure 7, where gas composition is plotted against temperature. As in the former case this curve is so drawn as to lie between the closest scaling and non-scaling mixtures at each temperature. The lower portion of this curve is taken from Schenck.[2] It will be noted that in both cases there occurs a sharp break in the curves at 1360° C. (2480° F.) This break occurs because of the melting of ferrous oxide. Consequently if the melting point of ferrous oxide, the chief component of scale, is exceeded, more hydrogen or more carbon monoxide will be required to prevent scaling. Finally, the curves presented in these figures divide all possible gas compositions into two sorts; either scaling, to the right of the curves, or non-scaling, to the left.

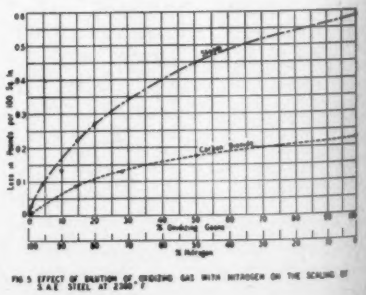


FIG 5 EFFECT OF VARIATION OF OXIDIZING GAS WITH NITROGEN ON THE SCALING OF S.A.E. STEEL AT 2300° F

[1] J. Am. Chem. Soc. Vol. 52, p. 4268-1930.
[2] Z. anorg. allgem. chem. *166*, p. 113, *167*, p. 254, *167*, p. 315.

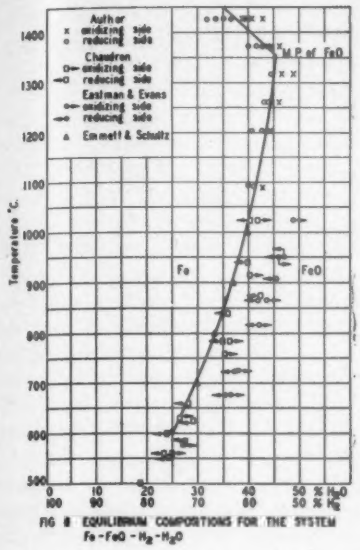


FIG 8 EQUILIBRIUM COMPOSITIONS FOR THE SYSTEM Fe-FeO-H_2-H_2O

The Scaling of Steel in Gas-Air Combustion Atmospheres

In Figure 8 are shown the results of exposing S.A.E. 1015 steel samples to various combustion atmospheres ranging in ratio from 2-air-to-1-gas to 6-air-to-1-gas at temperatures from 2000° F. to 2400° F. The curves, with the possible exception of that for 2400° F., are strikingly similar. Complete combustion for the particular gas being used was secured with a ratio of 4.75 parts air to 1 part gas. With ratios less than this, that is when excess gas was used, the general tendency is to reduce scaling losses, though this is not marked until the air-gas ratio has been decreased below 3 to 1. Non-scaling conditions are attained with ratios of 2 air to 1 gas and less.

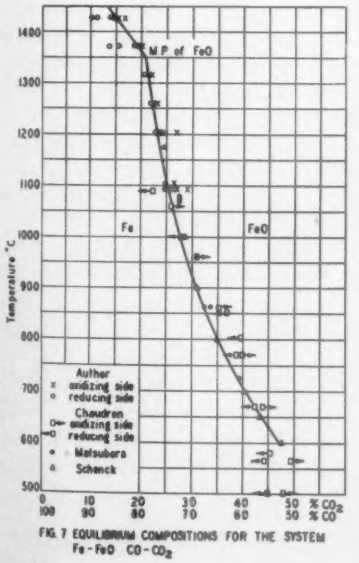


FIG. 7 EQUILIBRIUM COMPOSITIONS FOR THE SYSTEM Fe-FeO CO-CO_2

TABLE IV

Comparison of CO_2 — CO and H_2O — H_2 Ratios for Scaling and Non-Scaling Tests on Various Steels at 2300° F.

Run No.	*Steel*	*$\frac{\%CO_2}{\%CO}$ Ratio*	*$\frac{\%H_2O}{\%H_2}$ Ratio*	*Condition After Testing*
A1-19	1030	.346	.879	Scaled
A1-20	1030	.199	.479	Not scaled
A2-15	1050	.346	.880	Scaled
A2-17	1050	.199	.479	Not scaled
A3-10	1090	.675	1.85	Scaled
A3-16	1090	.199	.479	Not scaled
E-15	1.12%C	.333	.875	Scaled
E-17	1.12%C	.337	.310	Not scaled
FF-14	2320	.450	1.07	Scaled
FF-15	2320	.238	.639	Not scaled
G-14	3130	.431	1.07	Scaled
G-16	3130	.219	.495	Not scaled
Q-21	6145	.420	1.05	Scaled
Q-15	6145	.238	.639	Not scaled
L-11	4615	.610	1.36	Scaled
L-14	4615	.304	.670	Not scaled
KK-14	4140	.530	1.47	Scaled
KK-3	4140	.300	.520	Not scaled
YY-13	High speed	.354	.803	Scaled
YY-15	High speed	.238	.639	Not scaled
Value $\%CO_2/\%CO$ ratio from Figure 7		.288 at 2300° F.		
Value $\%H_2O/\%H_2$ ratio from Figure 6		.792 at 2300° F.		

At 2300° F. and 2400° F. the range of ratios was extended to 6 air to 1 gas. In these cases excess air was present and consequently free oxygen was always found in amounts ranging from about 0.5 to 4.0 per cent. It will be observed that the presence of free oxygen in combustion atmospheres leads to markedly increased scaling losses, especially at 2400° F. Such atmospheres as these must of course be avoided in operating furnaces.

The curves of Figure 9 were obtained when various plain carbon steels were subjected to atmospheres containing increasing percentages of carbon monoxide at 2300° F. The curves are very similar, as was to be expected, and show much the same characteristics as those of Figure 8. The reduction of scaling losses is not decidedly marked until considerable excess gas is used, leading of course to increasing percentages of carbon monoxide. The order of scaling, in decreasing magnitude, appears to be as follows: S.A.E. 1030; S.A.E. 1050; S.A.E. 1015; 1.12 per cent carbon steel; and S.A.E. 1090. Apparently carbon in the steel has but little influence upon the scaling losses. This work was next extended to include several of the more common alloy steels as shown in Figure 10. Here again, with the exception of high speed steel of the high tungsten type, the scaling losses are reduced somewhat gradually as the carbon monoxide is increased from 0 to 6 per cent, then more rapidly with further increases until non-scaling conditions are attained with atmospheres containing 15 to 17 per cent carbon monoxide.

In predicting the effect of any combustion atmosphere upon steel the equilibria discussed under Section II

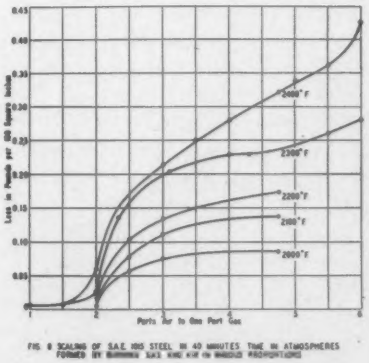


FIG. 9 SCALING OF S.A.E. 1015 STEEL IN 40 MINUTES TIME IN ATMOSPHERES FORMED BY BURNING GAS AND AIR IN VARIOUS PROPORTIONS

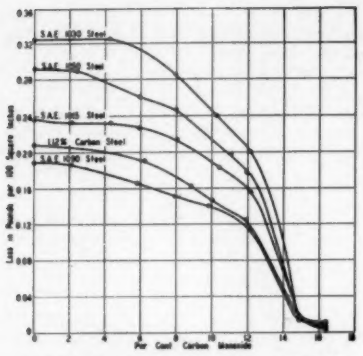


FIG. 9 SCALING OF PLAIN CARBON STEELS AT 2300° F IN 40 MINUTES TIME IN VARIOUS FURNACE ATMOSPHERES AS SHOWN BY THE LOSS IN WEIGHT OF THE STEEL

are of inestimable value. When city gas and air are burned, gas being in excess, carbon dioxide, carbon monoxide, water vapor and hydrogen are formed. These then adjust themselves at equilibrium in amount to conform to the water-gas constant for the particular temperature. The water-gas reaction $CO_2 + H_2 = CO + H_2O$ has as its equilibrium constant $K = \frac{[CO]\,[H_2O]}{[CO_2]\,[H_2]}$. This constant may likewise be derived from the reactions with iron;

$$FeO + CO \rightarrow Fe + CO_2 \quad K_1 = \frac{\%CO_2}{\%CO}$$

and

$$FeO + H_2 \rightarrow Fe + H_2O \quad K_2 = \frac{\%H_2O}{\%H_2}$$

by a simple division of K_2 by K_1. Hence if any atmosphere is to be non-scaling to steel it must have certain maximum ratios of $\frac{CO_2}{CO}$ and $\frac{H_2O}{H_2}$, since the non-scaling compositions must lie to the left of the curves of Figures 6 and 7.

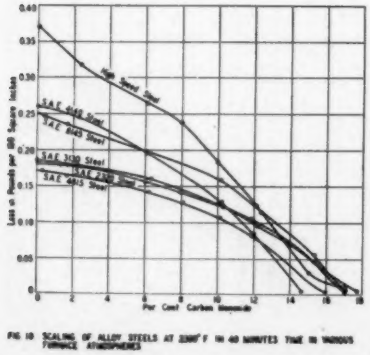


FIG. 10 SCALING OF ALLOY STEELS AT 2300° F IN 40 MINUTES TIME IN VARIOUS FURNACE ATMOSPHERES

For example, the maximum non-scaling ratios of $\frac{\%H_2O}{\%H_2}$ and $\frac{\%CO_2}{\%CO}$ at 2300° F. as determined from Figures 6 and 7 are 0.792 and 0.288 respectively. In Table IV are summarized a few of the data obtained during the investigation in which the atmosphere analyses are expressed as the ratios $\frac{\%CO_2}{\%CO}$ and $\frac{\%H_2O}{\%H_2}$. On the basis of the comparisons made in this table atmospheres whose ratios are in excess of the values 0.288 and 0.792 produce scaling at 2300° F., while those atmospheres whose $\frac{CO_2}{CO}$ and $\frac{H_2O}{H_2}$ ratios are below these values produce no scaling. In general it may be remarked, that at equilibrium, when one of these ratios is below the maximum, the other will be below also, and likewise that, when one is greater in value, the other will be greater. It would be much easier in plant practice, therefore, to use the more easily determined $\frac{CO_2}{CO}$ ratio as the criterion. It must be emphasized, though, that the success of this prediction is necessarily based upon the condition that equilibrium in the furnace atmosphere is attained before the steel surface is reached. Without such a condition any prediction would be unsafe.

The Effect of Small Amounts of Sulfur Dioxide in the Products of Combustion

The presence of 1 to 2 per cent of sulfur in some fuels could lead to sulfur gases in the furnace atmosphere in amounts up to 0.2 per cent. For most operating conditions this sulfur would be present in combustion gases as sulfur dioxide since it is only in the presence of considerable hydrogen and carbon monoxide that less oxidized forms are stable. Small amounts of sulfur dioxide are shown to be extremely powerful in their effect on scaling losses. This is illustrated in Figure 11 where scaling losses of S.A.E. 1015 steel at 2300° F. are plotted against per cent sulfur dioxide

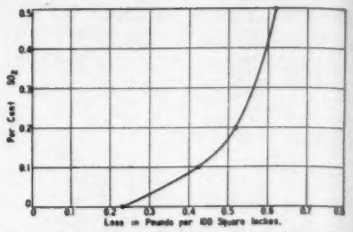


FIG. 11. EFFECT OF VARIATION OF PER CENT SO_2 ON SCALING LOSSES OF S.A.E. 1015 STEEL ATMOSPHERE—COMPLETE COMBUSTION OF CITY GAS AND AIR.

contained in atmospheres resulting from complete combustion of gas and air. An amount as small as 0.1 per cent sulfur dioxide nearly doubles the loss, increasing it from about 0.23 pounds per 100 sq.in. with no sulfur dioxide to 0.43 pounds per 100 sq.in. with 0.1 per cent. Further increases of sulfur dioxide, corresponding to the use of fuels containing upwards of 1.0 per cent sulfur, cause further increases in scaling losses.

The influence of sulfur dioxide on scaling losses increases rapidly with

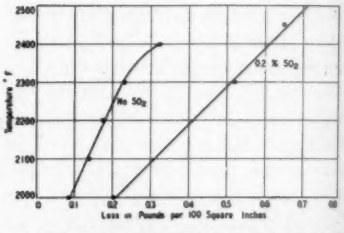
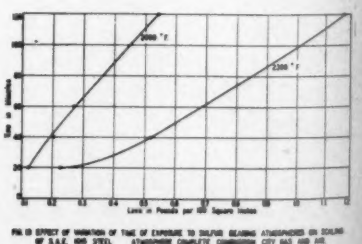


FIG 12 EFFECT OF VARIATION OF TEMPERATURE ON SCALING OF S.A.E 1015 STEEL IN SULFUR CONTAINING ATMOSPHERES COMPARED WITH NON SULFUR BEARING ATMOSPHERES. ATMOSPHERE COMPLETE COMBUSTION CITY GAS & AIR.

increasing temperature as shown in the curves of Figure 12, where losses are plotted against temperature for atmospheres containing no sulfur dioxide and for those containing 0.2 per cent. The curves for non-sulfur containing atmospheres and sulfur containing atmospheres become increasingly divergent at higher temperatures. The drastic effect of sulfur bearing atmospheres is likewise clearly evident in the curves of Figure 13 where scaling losses are plotted against time of ex-



posure at 2000° F. and 2300° F. Comparison of the form of these curves with the form of those in Figure 3, in which are given the results with the normal oxidizing components of combustion atmospheres, carbon dioxide and steam, shows that scaling in sulfur bearing atmospheres proceeds at an approximately constant rate, the scale having lost its protective qualities which caused the decreasing rates shown in Figure 3. Some of the alloy steels, particularly those containing nickel, are even less resistant to sulfur bearing atmospheres than the S.A.E. 1015 steel for which results have been shown.

Summary

In conclusion the points which have been discussed in this paper may be summarized in the following:

1. Scaling losses are affected by velocity of the gas stream only in the range of very low velocities, 0 to 10 feet per minute.

2. Scaling losses increase with increasing time, but the rate of scaling in sulfur free atmospheres decreases with increasing time.

3. Scaling losses increase decidedly with increasing temperature, becoming very great when the melting points of the scale, about 2480° F. is exceeded.

4. The effect of any combustion atmosphere upon steel with respect to scaling may be predicted from the equilibria data of the reactions $FeO + CO \rightarrow Fe + CO_2$ and $FeO + H_2 \rightarrow Fe + H_2O$.

5. Scaling losses in combustion atmospheres are increased by the presence of free oxygen and decreased by the presence of free carbon monoxide, though, to be sure, this decrease is not marked up to 6 or 8 per cent.

6. The presence of as little as 0.1 per cent sulfur dioxide in the products of combustion, seriously increases scaling losses at all temperatures in the forging range and larger amounts increase these losses still more.

The results of this investigation have shown unquestionably that control of atmosphere and temperature are of much importance in controlling scaling in the forging range. Gas-fired furnaces are the most susceptible to the accurate control of temperature and atmosphere necessary to reduce scaling. On the basis of the results of this research certain recommendations may be made regarding the operation of furnaces designed for use in hot working steel.

1. Free oxygen should be avoided in furnace atmospheres at all times.

2. Operation of most of the existing furnaces with amounts of excess gas sufficiently large to greatly reduce scaling would probably prove uneconomical for most work. It is advisable, however, to operate with a small percentage of carbon monoxide in the furnace atmosphere in order to insure the absence of oxygen.

3. The time of exposure of steel to furnace atmospheres should be kept as low as possible.

4. The temperature of exposure should in most cases, be kept well below the melting point of the scale, 2480° F., to avoid undue scaling.

5. Fuels high in sulfur are likely to cause extremely high scaling losses and their use cannot be recommended.

Acknowledgment

The author desires to express his appreciation to the Committee on Industrial Gas Research of the American Gas Association, whose financial support enabled this study to be made.

Predicts Metallurgy Developments Will Alter Banking Practice

THE banker of tomorrow will insist upon as accurate accounting of energy units as of physical inventories, it is predicted by Dr. Charles G. Maier of the U. S. Bureau of Mines in a report on developments in metallurgy which is to be presented at a national symposium of the American Chemical Society on "The Physical Chemistry of Metals" at Denver, Colo., August 22-26.

Improvements in metallurgical practice, which are proving effective in gold recovery and in producing iron by natural gas have been made possible by the application of the latest methods in thermodynamics, according to a summary made public by the society, of Dr. Maier's narrative of results achieved at the Pacific Experiment Station at Berkeley, Calif.

"The point of view is developed that thermodynamics is a type of chemical and metallurgical bookkeeping, where accounts are kept in calories, rather than ordinary commercial units," says Dr. Maier. "The metallurgist who does not keep thermodynamic accounts is as old-fashioned as the merchant who inventories on his cuff.

"The thermodynamic balance sheet of the metallurgist and chemist accounts for calories in heat content, in free energy, and in entropy, and from these descriptions of the material substances with which he works he is able to predict the course of chemical or metallurgical processes under circumstances that are often impractical to define by direct experimentation.

"The results of such predictions, which are much cheaper than direct tests, are of greatest use not only in correcting faults in operating processes, but also facilitate the development of superior, new methods of extracting metal from ore.

"Among the examples discussed where operating problems are solved by thermodynamic methods is that of gold recovery from a pyrite ore containing lead sulphide. In this case a thermodynamic study indicated the conditions of treatment which had to be maintained to avoid the formation of lead oxide in roasting, since this material caused the loss of a considerable portion of the gold content.

"An even more interesting example of the use of thermodynamics in pointing the way to a new metallurgical method that promises to be locally superior to older ones is that of producing iron by natural gas.

"Based on thermodynamic reasoning, a means was found at the Pacific Experiment Station of the United States Bureau of Mines to avoid the serious heat absorbing requirements entailed in the direct reduction of iron ores by natural gas, and at the same time permit of the production of nearly sulphur-free iron from rather high sulphur content ores locally available on the Pacific Coast."

Gas-Fired Unit Bright Anneals Copper Wire In Atmosphere of Steam

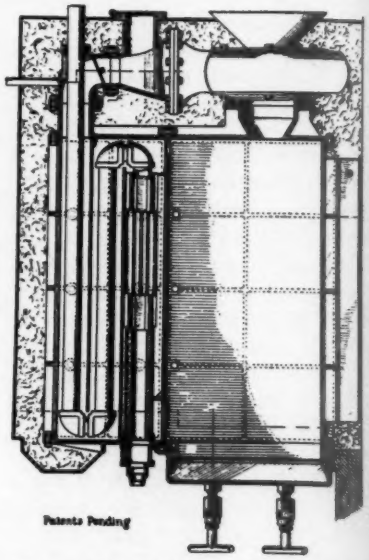
By J. B. Nealey
American Gas Association

THE constantly recurring problem of bright annealing copper wire has finally been solved in a most satisfactory manner by the use of an entirely new principle and gas fuel. A furnace has been designed, built and operated for over two years in which the necessary heat is applied to the work by convection of a heated fluid, steam, which is chemically inert with respect to the product. This furnace has a high thermal efficiency and anneals the product with absolute uniform ductility, free from discoloration and objectionable oxidation. With slight variations in temperature, the ductility of the annealed wire can be made from 25 to 40% softer than the code requirements. The idea was conceived and executed by S. B. Gamble, Industrial Gas Engineer of the Public Service Company of Northern Illinois, and S. M. Berolzheimer, Chief Engineer of the Diamond Braiding Mills.

The need for this furnace was due to the fact that bright annealed copper wire purchased in the open market, varied so much as to ductility that subsequent processing was uncontrollable. At least this was the experience of the Diamond Braiding Mills, Chicago Heights, Illinois, probably the only insulated wire plant in the United States which manufactures everything that goes into its product under one roof. This concern makes a complete line of the smaller sizes of insulated, flexible, electrical wire consisting of cords for lamps, heaters, vacuum cleaners, electric irons, toasters, hot plates, etc.; tensil cords for curling irons and hair clippers; all-rubber, portable cords for electrical tools and office appliances; heat resisting fixture wire; and asbestos insulated wire. Practically all of these are manufactured to the specifications of the Underwriters, Laboratories and bear their label. Complete cord assemblies are made up for the appliance manufacturers. This company also makes a great variety of stranded and braided copper wire products such as pigtail wire and braided copper for movable switch connections.

It was in the stranding processes that the trouble centered so the management decided to install its own copper wire drawing department. This necessitated the purchase of annealing equipment and a wide search was made by this concern for an annealing furnace which would permit control of ductility within much closer tolerances than that of the wire which they were formerly able to purchase on the open market. After thoroughly investigating all furnaces on the market, it was decided to accept Mr. Gamble's and Mr. Berolzheimer's design and build an unique gas heated bright annealing furnace.

A further object of the design of this new furnace was to permit skid loading so that a skid load of spools filled with copper wire could be wheeled into and out of the annealing chamber on a standard lift truck from floor level, thereby eliminating the necessity for cranes, hoists and the like, together with considerable rehandling incident to the operation of competitive annealing units. Another advantage over other furnaces is that the treated material can be cooled or quenched without the use of a tank or auxiliary cooling chamber. In fact, the material is removed from the furnace as a finished product, quenched, dry, annealed and clean.

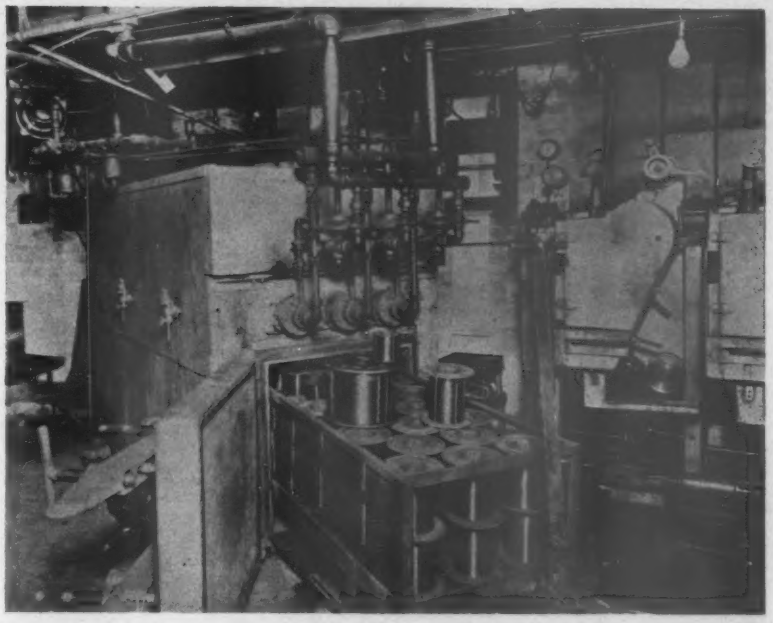


Cross section of side elevation of annealer showing steam superheater, annealing chamber, circulating fan, etc.

The annealing chamber and gas-fired steam superheater, comprising the two most essential parts of this furnace, are built together so as to eliminate pipe connections and to increase the thermal efficiency. The top wall of the annealing chamber constitutes the bottom wall of the superheating chamber. The gas-fired superheater comprises a rectangular flow chamber co-extensive in length and width with the annealing chamber. The rear end wall of the superheater is formed along its upper edge with a rectangular transverse inlet duct which is vertically aligned with the periphery of a

power-driven exhauster. A number of horizontal baffle plates extend longitudinally through the superheating chamber designing a tortuous passage for the steam. Gas-fired immersion heaters are employed in the superheater. Gas burners of the proportional gas and air mixer type fire into tubular refractory lined combustion chambers, discharging into tortuous heating tubes arranged so that the products of combustion counter-flow the superheated steam. The gas is fired "full muffle" and the products of combustion are eventually vented to the atmosphere. The superheater is connected with the annealing chamber through a number of transversely aligned openings in the front end of the top plate of the rectangular annealing chamber. The rear end wall of this annealing chamber is formed with a short duct designing a discharge passage connecting with the intake of the aforementioned exhauster. The periphery of this exhauster connects with a vertical discharge duct into which is connected a horizontal sleeve leading to a weight loaded flap valve discharging to the atmosphere. This vertical duct in alignment with the periphery of the exhauster is further provided with a butterfly valve introduced above the horizontal sleeve which connects with the flap valve. When this butterfly valve is open, steam is recirculated from the annealing chamber under the propulsion of the exhauster and driven through the superheater and back through the annealing chamber. The furnace is heavily lagged with insulation and sheet metal.

In operation this furnace will anneal indiscriminately copper wires of various sizes and weights, on spools of the same size or different sizes, at the same time. Also, the wire is annealed on the same spool on to which it is cold drawn and from which it is later unspooled for stranding. When the furnace is loaded the burners are ignited and the exhaust fan started with the butterfly valve closed so that the steam, drawn from the plant's steam lines, after circulating through the superheater and annealing chamber, respectively, is exhausted to the atmosphere, thus purging the system of air. The butterfly valve is then opened and the steam caused to recirculate through the system, joining with any new steam from the plant's steam lines, and is obviously reheated in the course of its return flow. A small amount of steam does escape past the weight loaded flap valve which acts in the capacity of a weighted pressure relief valve. The pressure within the annealer is only slightly above atmospheric pressure to prevent any possible infiltration of air.

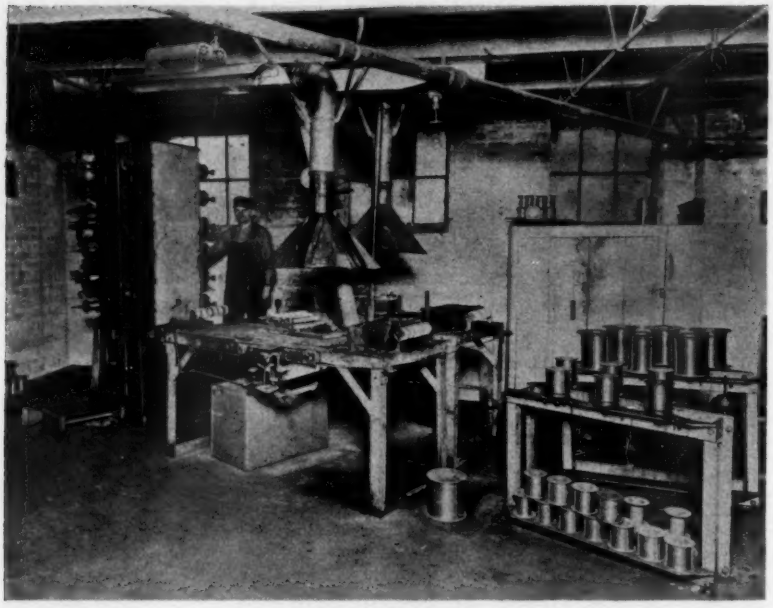


Front view of annealer showing potentiometer controller in background, also proportional mixing gas burners—wire drawing machines at extreme right foreground. Note large and small spools and different size wires in same load

The use of superheated steam as a heating medium and its circulation through the system at a terrifically high velocity makes it possible to maintain high temperatures without entraining a large volume of heat. This affords a sensitive control over a wide range of the rate at which the work is heated. The superheated steam permeates all the interstices of the work due to the high velocity, thus resulting in obtaining substantially the same temperature throughout the entire mass in the furnace.

The temperature is caused to rise gradually to the desired point (525° F.) under automatic pyrometric control. After the product is annealed, *sans* any soaking period, the gas burners are extinguished and water is injected into the steam passage, thus cooling the chamber and quenching the work with the latent heat of vaporization of the water introduced with the steam. Thus the product is quenched within the furnace without the use of a tank and is then removed in a clean dry state. In general, the product—copper wire—is clean, dry, uniformly soft and ductile, free from water discoloration and oxidation and has a bright finish. Copper will oxidize in air at temperatures down to 160° F. and even slowly at room temperatures. If unusual requirements necessitate such, the system may be operated under vacuum until the product is cooled below 160° F. The thermal efficiency of the furnace is high, the heat penetrates uniformly to all parts of the product and is readily controlled, and the operation is carried out with a minimum handling of the product.

The closest competitor was an electric furnace, inverted over a pool of water that served as a seal to the furnace. Heat was supplied through



Gas-fired burning pots in which fine copper wire is tinned continuously and automatically by passing wire through mechanically. Single-strand annealed wire on spools right from annealing furnace is unwound, tinned, wiped and rewound in a single continuous operation

radiant elements disposed about the inside wall of the furnace and a weighted flap valve at the top was provided to vent the excess steam generated by the heat in surface contact with the water. This furnace operated at a temperature upwards of 900° F., which was nearly twice the required temperature of 525° F. The manufacturers of this furnace later substituted another design—the hermetically sealed, retort type of furnace.

The idea back of this new type was to enclose a few spools of copper wire in a silver soldered copper retort which is scavenged of air and sealed after filling with an inert gas such as hydrogen, specially treated city gas, products of combustion of city gas, combinations of nitrogen and hydrogen and others. This retort is then introduced into a radiant heat furnace and the whole brought up to annealing temperature, after which it is removed and allowed to cool to approximately room temperature. The copper wire is then removed, supposedly bright and soft. This type of furnace is costly, its use necessitates extensive handling, occupies a large amount of valuable floor space, is uneconomical of fuel and does not lend itself to accurate temperature control within the interstices of the spooled wire.

The transmission of heat in this hermetically sealed retort type of furnace is very largely by radiation. To be sure a small amount of heat will travel by conduction through points of contact of the spools with the retort and of the retort with the furnace and also through the wire through the outer layers toward the core of the spool. A still smaller amount of heat will be convected by the inert gases within the retort due to their propulsion under stack action. On the other hand, these inert gases seriously impede the more essential radiant transfer of heat.

Therefore, in order to radiate a sufficient volume of heat to provide an annealing temperature within the wire itself within a reasonable time period, it is obligatory to maintain a large temperature differential between the furnace and the wire. This results in complicating the very important element of "control." "Control" may no longer be intrusted to a reliable pyrometer alone but is interlocked with many factors:

1. Temperature of furnace.
2. Gauge of wire.
3. Weight of spools.
4. Physical size of spools.
5. Time allowed in furnace.

On the other hand, in the new gas-fired convection heating annealer the item of "control" is primarily vested in a temperature recorder controller with the elimination of 80% of the interlocking factors incident to the operation of a radiant heat annealer.

Very important are the factors pertaining to spool sizes in a radiant heat type of furnace and even when like gauge sizes are treated on similar spools, the outer layers of wire take a higher temperature than the innermost layers, resulting in nonuniformity. In the case of the gas-fired convection annealer the maximum rate of temperature rise can be and is limited to the speed at which the heat will uniformly penetrate the spools of wire so that all of the wire reaches an annealing temperature within the space of a very few minutes. This precludes the possibility of "stickiness" brought on by prolonged soaking of any part of the spool at temperatures above which molecular intergrowth between adjacent strands of wire is likely to occur. Elimination of the factors which are liable to produce "stickiness" has permitted the Diamond Braiding Mills to use much larger spool sizes for a given gauge size than has ever been successfully employed in other annealers. Specifically the gas-fired convection heating annealer has demonstrated its superiority over the radiant heat type in its ability to handle different gauges of fine wire on spools ranging from 5 to 65 pounds in weight, in the same charge subject to the same annealing cycle. Heavy copper wire up to No. 8 in loose bundles has been placed in this furnace with No. 36 gauge on 10-pound spools. All of the wire came out of the furnace bright, and uniformly annealed to the desired ductility.

The radiant heat, retort type furnace is naturally limited as to size, whereas the gas-fired, convection heat type will operate efficiently regardless of size; which can be increased to meet the production schedules of any plant.

Manufacturers to Meet In Annual Conference at Cincinnati, Sept. 22-23

D. F. Kahn

THE annual conference of the Manufacturers' Section of the American Gas Association takes place September 22-23, in Cincinnati, Ohio. Probably the outstanding report to be made will be that of the Range Division on its proposed national cooperative advertising campaign. Necessary preliminary work looking toward the expenditure of $6,000,000 in this movement, over a three-year-period, is about complete, and the report covering progress to date will be submitted by the Manufacturers' National Subcommittee, which is composed of John A. Fry, chairman; Philip O. Deitsch, secretary; David F. Kahn, chairman of the Section; and W. Frank Roberts, chairman of the Range Division.

It is the aim of members of the Range Division to focus public attention on the modern gas stove. Mr. Fry and members of his committee are convinced that the campaign will make the public more than ever conscious that the gas range will do more than any other piece of equipment to lessen the housewife's burden. Companies participating in this campaign have been assured of its success because of the tremendous public acknowledgment of gas as a cooking fuel, and on account of that acceptance there is a replacement market of more than ten million units waiting to be tapped. They feel that a truly progressive and aggressive campaign, such as they are about to undertake, is sure to be productive of good results.

In view of the interest aroused, members of other groups within the Manufacturers' Section have expressed the opinion that they anticipate the Water Heater and Boiler Divisions likely will undertake a similar campaign, provided the range manufacturers are able to demonstrate the soundness of exploiting gas and gas appliances and equipment.

At the request of a majority of the membership of the Manufacturers' Section, the A. G. A. Executive Board authorized the temporary suspension of the exhibit of appliances and equipment at the Convention, which will take place at Atlantic City, N. J., October 10-12, "because," as the manufacturers explain, they "desire to divert funds used for the exhibit to further the advertising program."

In his annual report to the section, Chairman Kahn will give an over-all view of the section's 1931-'32 accomplishments. Mr. Deitsch, as manager of group activities, will submit a general review of association policies as exist today contrasted with those of the appliance organization conditions which prevailed at the time of the formation of this new work. Definite recommendations covering the future policy of all divisions also will be submitted by Mr. Deitsch.

Sessions of the group probably will take place at the Netherlands Plaza, Cincinnati. Apart from the report covering the advertising campaign, there will be a general review of the section's group activities, which began more than a year ago. The following divisions have been created since that time: Range, Water Heater, Space Heater, Gas-Fired Boiler, Gas-Fired Steam Radiator. Each group operates under the direction of a chairman, vice-chairman and secretary.

Problems common to each branch will be discussed. Foremost among these will be the following subjects: Cross-licensing of patents, designed to reduce patent litigation and provide a fair deal for patent owners; standards of practice, which are aimed to minimize or eliminate entirely costly merchandising practices and unethical methods which have been manifest in the past.

The conference will open on the morning of September 22 with a general session, followed by a joint-luncheon. At this time various committees, including the Nominating Committee, will report. The afternoon will be open for committee meetings and unfinished business. The second day will be given over to separate meetings of each division.

Mr. Welsh Named President N. Y. and Richmond Gas Co.

W. J. Welsh

THE following officers and directors have been elected by the New York and Richmond Gas Company, Staten Island, N. Y.:

William J. Welsh, president; Joseph H. Maloy, vice-president; John Kohout, secretary and treasurer; August Muller, assistant secretary, and Joseph M. Bell, assistant treasurer.

Directors—George E. Devendorf, Jacob H. Goetz, John Kohout, Edward L. Love, Joseph H. Maloy, William J. Welsh and George D. Wood.

British Association To Meet at Leeds

Information has been received from London, England, announcing that the twenty-first annual general meeting and conference of the British Commercial Gas Association will take place September 26-28, inclusive, at Leeds. Several distinguished guests are expected to take part in the program, including Prince George.

A. G. A. Affiliated Associations

How They Started and How They Have Grown

By B. H. Smyers, Jr.
Secretary

PENNSYLVANIA NATURAL GAS MEN'S ASSOCIATION

Herewith is the eighth of a series of articles appearing in the "A. G. A. Monthly" giving an outline of the history and accomplishments of State and district utility associations which are affiliated with the American Gas Association. Work of these associations has proved of great value and a distinct contribution to the advancement of the gas industry. It is believed that this series will focus yet greater attention on the splendid records of these organizations.

HAVING just completed its eighth year, the Pennsylvania Natural Gas Men's Association might be considered rather youthful among the various older local and state associations affiliated with the American Gas Association, but it is, nevertheless, a husky and robust youngster and has been successful along the lines planned for it.

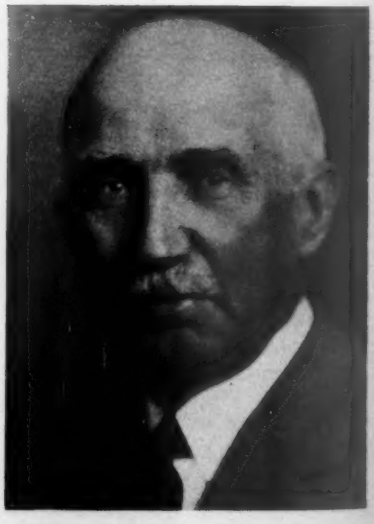
The guiding thought in the organization and functioning of the Association is to foster personal contacts and fellowship between individuals identified with the natural gas business in Pennsylvania, at the same time affording an instrumentality for united action upon important matters, assisting in research for their common benefit, and developing and disseminating statistical data regarding the industry.

J. French Robinson, president, Pennsylvania Gas Men's Association

The active membership of the organization is limited to individuals. Their election to membership is by approval of the Board of Directors. By custom, the number of members from any one company has been reasonably limited with respect to the size of the company and the number of members from other companies of approximately the same size. Thus maintaining the number of members from any one company substantially in proportion with the size of the company accomplishes a two-fold benefit—first, preventing the organization from being unduly controlled by members from any one company, and second, providing a simple and equitable means of raising special funds by membership assessment for special purposes having to do with the welfare of the industry as a whole. Only ane such assessment, however, has been necessary during the life of the Association.

The Association might be said to have been born at a dinner meeting on May 9, 1924, at the University Club, in Pittsburgh, attended by about thirty executives of various natural gas companies operating throughout the western portion of Pennsylvania.

The organization chose as its first officers: President, Alfred Hurlburt, then vice-president and general manager of the Equitable Gas Company, Pittsburgh; vice-president, B. D. Phillips, vice-president of the Phillips Oil and Gas Company, Butler; and secretary-treasurer, E. J. Stephany, then with the Equitable Gas Company, and a former secretary of the Natural Gas Department of the American Gas Association.



E. S. Templeton, past president, Pennsylvania Gas Men's Association

The Association, since its beginning, has held monthly dinner meetings, except during the summer. At these dinner meetings a speaker usually discusses some important problem or phase of the natural gas business, following which the members are asked to question the speaker more fully, and to comment upon the subject from their individual viewpoints. The Association inconveniences its members as little as possible with business details, the principal work being handled by a representative Board of Directors composed of eleven members and by certain standing and special committees.

The Association has held two conventions, the first at Butler, Pennsylvania, in 1928, and the second at Oil City, Pennsylvania, in 1930. Two-day programs were arranged covering a wide field of subjects and allowing for ample discussion. These conventions, conducted on a registration fee basis, and open to all interested in the programs offered, were enthusiastically supported by both large and small companies in the industry, and were the occasion of cordial hospitality on the part of local gas men and other business interests, including the press.

Members of this Association, with the assistance of A. G. A. Headquarters, have sponsored at Pittsburgh for several years an Eastern Gas Sales Conference on natural gas marketing problems. These two-day sessions include programs arranged particularly for the benefit of gas sales representatives from Ohio and West Virginia, as well as Pennsylvania, and have been highly successful both in attendance and in interest shown.

A popular annual event of the Association is its golf party, usually held at one of the country clubs near Pittsburgh, immediately preceding dinner and the annual meeting.

According to custom, on June 28 the golfing members of the Association, thirty-eight in number, fittingly celebrated the close of the Association's eighth year by assembling their sticks at the Pittsburgh Field Club for a session of "Kickers Handicap." P. L. Mulkin, of the United Natural Gas Company, Oil City, and

B. H. Smyers, Jr., secretary-treasurer, Pennsylvania Gas Men's Association

T. H. Kendall, of the Equitable Gas Company, Pittsburgh, shared Kickers Handicap prizes, while C. H. Rupp, of the Peoples Natural Gas Company, Pittsburgh, was rewarded for low gross and H. L. Smith, of the Carnegie Natural Gas Company, Pittsburgh, was "consoled" for high gross.

Your humble scribe was blessed and cursed alternately,—depending upon what happened—as he succumbed to an amateur's urge to make movie shots of the various members in action. If the author's shots prove as successful as some of those of his subjects, posterity may have preserved for it a glimpse of how gas men act when they are merely drilling in "sands" along the surface.

Dinner in the evening was followed by the annual meeting. E. S. Templeton, lawyer and former head of several natural gas and artificial gas companies in and near Greenville, Pennsylvania, brought to a close his term as president of the Association and his eighth year as a member of its Board of Directors.

The applications of L. W. Heath and Colin R. McIntosh for membership were accepted, bringing the Association's present membership to forty-nine.

The Association greatly appreciated the special effort which Captain A. E. Higgins, secretary of the A. G. A. Natural Gas Department, made to be present for both the golf party and the annual dinner meeting. Captain Higgins made a short humorous talk as did also G. H. Neilson, past president of the Engineers Society of Western Pennsylvania, another guest of the Association.

The Association re-elected the previous Board of Directors:

T. B. Gregory, vice-president of Columbia Gas and Electric Corporation; S. W. Meals, president of Carnegie Natural Gas Company; B. D. Phillips, vice-president of Phillips Gas & Oil Company; F. R. Phillips, president of Philadelphia Company; George W. Ratcliffe, president of Manufacturers Light & Heat Company; J. F. Robinson, general manager of Lycoming Natural Gas Corporation; F. F. Schauer, vice-president of Equitable Gas Company; E. S. Templeton, attorney-at-law; J. B. Tonkin, vice-president of Peoples Natural Gas Company; George E. Welker, president of United Natural Gas Company; and George Wittmer, Jr., vice-president of American Natural Gas Company.

At a subsequent meeting of the Board, J. French Robinson, general manager and director of Lycoming Natural Gas Company, was elected president of the Association for the year 1932-1933, while F. F. Schauer, vice-president and general manager of Equitable Gas Company, was elected vice-president, and B. H. Smyers, Jr., secretary-treasurer.

The new president, Mr. Robinson, in addition to his position with the Lycoming Natural Gas Corporation, is chief engineer and geologist for Peoples Natural Gas Company. He is well known in engineering circles and has been active in the affairs of the American Petroleum Institute.

The Pennsylvania Natural Gas Men's Association looks to the future with the hope and expectation of ever-increasing usefulness and service, and welcomes into its membership persons of high character and good standing whose occupation identifies them with the natural gas industry in Pennsylvania.

Two Lone Star Employees Win Prizes for Talks on Benefits of A. G. A. Course

APPROPRIATE ceremonies and a speaking contest marked the completion of the American Gas Association Employee-Customer Relation Course in the Fort Worth Division of the Lone Star Gas Company, Fort Worth, Texas, in June. In the presence of company executives and a large number of employees, Leonard F. Dickinson, credit department, and Miss Mildred Grant, bookkeeper, were awarded first and second prizes, respectively, for their talks on "What the A. G. A. Employee-Customer Relations Course Means to Me." In recognition of their fine addresses each received an appropriate cash award.

Under the direction of Wesley F. Wright, division manager, and Eugene Whitcomb, new business manager, four classes, using the A. G. A. Course, were conducted, with an enrollment of 100. These were the first classes in the Lone Star Group to finish the course.

In the speaking contest, a representative of each class was chosen to make a brief talk. Mr. Wright acted as chairman of the meeting, while Mr. Whitcomb outlined the manner in which the classes were conducted. Will C. Grant, advertising manager of the Lone Star Company, directed the contest, and the session was closed with remarks by Henry C. Morris, president and general manager of the Dallas Gas Company and chief operating executive of the Lone Star system.

L. B. Denning, president of the Lone Star Gas Company, also was present and spoke.

Mr. Morris emphasized the value of good will and pointed to the results which, he predicted, would follow from the studies of the employees who completed the course. Mr. Denning told his audience that every contact with a customer has a possibility for making a friend for the company.

Among other things, Mr. Dickinson said:

L. F. Dickinson

"One of the most material benefits I can think of that I have received from the group discussions of the Employee-Customer Relations Course is that we as contact employees in the office have become better acquainted with our fellow employees in the shop and street departments. We have told them of our problems and they have told us theirs. With this better understanding between ourselves, we are in a much better position to cooperate in satisfying our customers' wants and needs.

"These group discussions have thoroughly disproved the old theory that 'a strong back and a weak mind,' were all a construction man needed, to be able to hold his job. I learned of the many intricate problems with which construction men are confronted in their daily work; how a main line foreman must be forceful enough to engineer the laying of a pipe line across a river bed or tunnel under a great embankment, yet he must be gentle enough to replace flowers in front of homes, where he has to disturb them while digging in the parking. The men in our construction department of necessity have strong minds as well as strong backs.

"The American Gas Association Employee-Customer Relations Course and the group discussions have made me realize more fully the importance of progressing personally, as my company progresses, so that when better positions are open, I can feel that I am qualified for promotion because of my knowledge of the present-day gas business, and that I no longer rely upon my past experience, which so soon becomes out-of-date."

In her talk, Miss Grant said it was important that a public utility employee must keep abreast of the times and constantly improve his knowledge of his business.

"Besides learning the difference between a public utility and any other business and how this affects the employee," she explained "I have been brought forcibly to realize how many little things go into the composition of an efficient employee:

Miss Mildred Grant

"First, my personal appearance, and to me, this means cleanliness, the proper kind of clothes, care of my hair, skin, teeth and hands. We can't all have the same degree of beauty, character and personality, but each of us can strive to make the most of what we have.

"In the second place, my willingness to serve the public, and perhaps this is the most important of all. That is the main object of any utility—to give the best service possible to the people in its territory. And since contact with the public is made through the employees of the company, it is up to each and every one of us to be on tiptoe every minute, lest we fail in that service.

"I appreciate the opportunity I have been given to attend these classes," Miss Grant added, "and I am sure I am expressing the opinion of each and every one of those with whom I work, when I say it has been of the greatest benefit to all of us."

Affiliated Association Activities

Pacific Coast Gas Association

James L. Stone

PRESIDENT James L. Stone announces that the thirty-ninth annual convention of the Pacific Coast Gas Association will take place August 24, 25 and 26 at the Hotel Del Monte, Del Monte, California.

The three-day convention will be devoted to an intensive discussion of the load-building problems of the gas industry as they are affected by present business conditions and acute competition from oil and electricity. Special attention will be given to developing plans for the continuance of the regional cooperative advertising in which the Pacific Coast Gas Association has been a leader, and several representatives of outside industries, who have successfully conducted cooperative business development campaigns, will appear on the convention program.

On the day preceding the convention, August 23, a special meeting of gas company sales executives will be held to discuss the work being done by the association's Trade Relations Committee. This committee, working in conjunction with the Pacific Coast Electrical Association, has had a man in the field for several months making a special study of the relations between dealers and utilities in an effort to arrive at an equitable solution of the appliance merchandising problem.

Amendments to the constitution of the association will be voted upon, and, if approved by the membership, will establish a Manufacturers' Section within the association. This section will act in conjunction with the Manufacturers' Section of the American Gas Association.

Gas industry leaders of the Pacific Coast who will participate in the program include P. M. Downing, vice-president and general manager of the Pacific Gas and Electric Company; A. B. Macbeth, president of the Southern California Gas Company; and R. E. Fisher, vice-president of the Pacific Gas and Electric Company and past president of the association.

A representative of the Manufacturers' Section of the American Gas Association has been invited to appear on the program and take part in the inauguration of the Pacific Coast Section.

Del Monte, California, where these meetings will be held, is one of the beauty spots of the Pacific Coast and is situated in the heart of the famous Monterey Peninsula. Near-by are the famed artists' colony of Carmel-by-the-Sea and equally famous Pebble Beach Golf Course.

Convention Calendar

August

22-25 American Chemical Society
Denver, Colo.

24-26 Pacific Coast Gas Association
Del Monte, Calif.

25-26 Wisconsin Utilities Association, Commercial Section
Eau Claire, Wisc.

September

14-16 National Petroleum Association
Atlantic City, N. J.

15-17 American Trade Association Executives
Atlantic City, N. J.

October

3- 5 American Society Testing Materials
Buffalo, N. Y.

3- 7 National Safety Council Congress
Washington, D. C.

4- 5 Indiana Gas Association
French Lick, Ind.

10-12 AMERICAN GAS ASSOCIATION
Atlantic City, N. J.

November

1- 2 Institution of Gas Engineers
Annual Research Meeting, London, England

15-17 American Petroleum Institute
Houston, Texas

Wisconsin Utilities Association

PLANS for the annual Commercial Section conference of the Wisconsin Utilities Association are nearing completion. Sessions will be held at the Eau Claire Country Club and headquarters will be at the Eau Claire Hotel, Eau Claire, Wisconsin, on Thursday, August 25 and the following day.

There will be several outside speakers on the program including H. E. Young, vice-president of Northern States Power Co., Minneapolis; C. E. Greenwood, commercial director, National Electric Light Association, New York City; Eugene D. Milener, industrial research representative, American Gas Association, New York City; C. E. Redfield of American Gas Products Corp., New York, and W. T. McCaskey, president, Franklin Electric Co., Chicago.

Mr. Redfield has been gaining considerable success in addressing sales groups about the country. Mr. McCaskey operated one of the plants in Eau Claire in 1883 and has traveled in many foreign countries on various phases of the development of electric service. There will also be a representative of the Wisconsin Association of Contractor Dealers and, perhaps, other merchandisers of gas and electric appliances.

From the association's membership, President Steinberg, Chairman Jasperson, Chairman C. C. Bell, of the Rural Electric Service Committee, will be heard from as well as several short presentations being developed by the Gas Merchandising Committee and other committees will, undoubtedly, present up-to-date problems and progress.

Several associate members will exhibit at the hotel and Vice-Chairman Davey is working on plans for a presentation on air conditioning.

There will be opportunities to visit the largest hydro-electric plant in the State, at Wissota, and one of the newest large hydro plants at Chippewa Falls. The annual dinner will include an address and several features of entertainment.

Hotel reservations should be made direct with the Eau Claire Hotel, stating the approximate hour of arrival.

More Post Offices to Use Gas for Heating

THE United States Treasury Department has selected gas as the fuel for heating the following post-office buildings:

Bay City, Texas—Served by the Texas Natural Gas Utilities Co., estimated annual consumption 250,000 cu.ft.

Harlingen, Texas—Served by the Rio Grand Valley Gas Co., estimated annual consumption 500,000 cu.ft.

Alexandria, La.—Served by the City of Alexandria Gas Dept., estimated annual consumption 3,000,000 cu.ft.

Ada, Okla.—Served by the MacThwaite Oil & Gas Co., estimated annual consumption 2,000,000 cu.ft.

Memphis, Tenn.—Served by the Memphis Power & Light Co., estimated annual consumption 5,000,000 cu.ft.

Tobele, Utah—Served by the Wasatch Gas Co., estimated annual consumption 1,000,000 cu.ft.

Big Spring, Texas—Served by the Empire Southern Gas Co., estimated annual consumption 1,000,000 cu.ft.

Kingsville, Texas—Served by the Tex-Mex Natural Gas Co., estimated annual consumption 500,000 cu.ft.

Gas Company Wins in 3 Advertising Contests

WINDOW display and poster advertising of the Consolidated Gas Company of New York received special honors recently by winning prizes in three national contests. A window display won first prize in the George Washington Bicentennial Contest conducted by the International Association of Display Men. This award is considered to be of unusual importance, since window displays of department stores, banks, and all classes of business institutions in the United States and Canada were entered. The award includes a certificate signed by President Hoover, and filing of a photograph of the winning display in a permanent exhibit at Washington. Another display won first prize in Class 7 of a contest sponsored by the Merchant's Record and Show Window. This class included public utility and bank displays. A poster of the company was also awarded second prize in the Electric, Gas, and Transportation Division of a national contest conducted by the Public Utilities Advertising Association. R. M. Martin is Director of Display for the Consolidated Gas Company of New York.

More Federal Buildings Install Gas for Heating

ATTENTION of A. G. A. members is called to the following extract from a letter, dated April 11, addressed by Managing Director Forward to member company delegates:

"The Executive Board having authorized the employment of a representative of the American Gas Association in Washington, D. C., George W. Bean has been selected for that purpose.

"In matters pertaining to all branches of governmental construction and equipment projects, and in cooperation with the personnel and material at Association Headquarters, it is believed that Mr. Bean's services in behalf of the industry will be valuable.

"We are, therefore, now in position to give a service heretofore unavailable to our gas company and our manufacturer company members in connection with business with the United States government and related activities."

Gas company members undoubtedly will be interested in the following memorandum of business closed with the Treasury Department up to and including June 30, 1932, for heating post-office buildings:

New Buildings

City and State	*Estimated Annual Gas Consumption*
McAllen, Texas	500,000 cu.ft.
Kingsville, Texas	500,000 cu.ft.
Harlingen, Texas	500,000 cu.ft.
Big Spring, Texas	1,000,000 cu.ft.
Little Rock, Ark.	10,000,000 cu.ft.
Tooele, Utah	1,000,000 cu.ft.
Ada, Okla.	2,000,000 cu.ft.
Alexandria, La.	3,000,000 cu.ft.

Converted from Coal to Gas

Aberdeen, Miss.	1,200,000 cu.ft.
Laurel, Miss.	1,200,000 cu.ft.
Meridian, Miss.	1,300,000 cu.ft.
West Point, Miss.	1,000,000 cu.ft.
Auburn, Ala.	1,000,000 cu.ft.
Columbus, Miss.	900,000 cu.ft.
Tupelo, Miss.	800,000 cu.ft.
Opelika, Ala.	900,000 cu.ft.
Talladega, Ala.	900,000 cu.ft.
Vicksburg, Miss.	3,000,000 cu.ft.
Memphis, Tenn.	5,000,000 cu.ft.
Bay City, Tex.	250,000,000 cu.ft.

In the interests of efficient and concerted action, A. G. A. members are requested to furnish Headquarters with copies of all correspondence directed to the Washington office.

Safety Items

AT the close of business on June 16, the Elizabeth Street branch of the Customers' Service Department of the Consolidated Gas Company of New York, New York, N. Y., completed its fifth consecutive year of operation without an accident involving loss of time on the part of any employee. This constitutes a record for the company and gives the Elizabeth Street Branch the distinction of being the first to merit the company's special five-year award. This special award is a silver bar for the inscribed safety plaque that is given to all Departments after completing their first no-accident year. Bronze bars are awarded for each subsequent year without a lost time accident, and the silver bar is for those departments achieving a record of five consecutive years.

Unique Campaign

THE following item is taken from the *Oil City Derrick:*

"Only one relation usually applies to a combination of gas and turtle and that is soup. Now there is another association between the two and that is safety. The gas-turtle-safety combination is being used by the field department of the United Natural Gas Company and associated companies of Oil City so effectively that lost time accidents have become negligible.

"The winner in this sort of safety contest is awarded a flag and the loser, or the field with the worst accident record, is awarded the custody of a common ordinary variety of turtle to keep until some other field makes a worse safety record. The awarding of the turtle involves payment of transportation charges, upkeep of the unwanted prize, and the replacement if lost or deceased."

Further information regarding this unusual accident prevention campaign may be obtained by addressing W. H. Locke, vice-president, United Natural Gas Company, Oil City, Pa.

Use of Natural Gas Spreads in Virginia

THE Virginia Gas Distribution Corp., a subsidiary of the Columbia Gas & Electric Corp., has purchased the Staunton and Waynesboro, Virginia, properties of the Consumers Utility Co. Plans are being made to substitute natural gas for manufactured gas within a short time.

The Virginia Gas Distribution Corporation recently completed a 20-inch pipe line through the Staunton section from Kentucky and West Virginia fields. Lexington, Clifton Forge and Covington are among the Virginia towns already receiving natural gas from the line, according to Carl Riddleberger, local manager.

Columbia System Executives Meet at Dayton, O.

Herewith is a group attending a recent meeting of the board of directors of the Columbia Engineering & Management Corp. and presidents of the operating groups at Dayton, Ohio. They are left to right, front row—F. M. Tait, president, Dayton Power and Light Company; Phillip G. Gossler, president, Columbia Gas and Electric Corporation; O. H. Hutchings, vice-president and general manager, Dayton Power and Light Company; Paul S. Clapp, vice-president, Columbia Gas and Electric Corporation; H. C. Blackwell, president, Union Gas and Electric Company, Cincinnati; F. W. Crawford, vice-president, Columbia Gas and Electric Corporation, and chairman of board of Columbus, Ohio, directors.

Middle row—C. I. Weaver, president, Columbus, Ohio, operating group; Edward Reynolds, Jr., executive vice-president and secretary, Columbia Gas and Electric Corporation; Judge E. P. Matthews; H. H. Pell, Jr., assistant secretary, Columbia Gas and Electric Corporation; T. R. Weymouth, vice-president, Columbia Gas and Electric Corporation; B. H. Gardner, director of sales, Columbia Engineering and Management Corporation; R. H. Delafield, vice-president, Columbia Gas and Electric Corporation.

Top row—Charles E. Bennett, president, Binghamton group; L. A. Seyffert, vice-president, Columbia Gas and Electric Corporation; George W. Ratcliffe, president, Pittsburgh group, and assistant treasurer, Columbia Gas and Electric Corporation; Raymond Gross, vice-president, Columbia Gas and Electric Corporation; and H. M. Wade, secretary to Mr. Gossler.

A Timely Appeal

Above is an example, supplied by the Consolidated Gas Company of New York, of how to tie in window displays with a seasonal appeal

Accounting Section

Wm. A. DOERING, Chairman — H. W. HARTMAN, Secretary — J. M. ROBERTS, Vice-Chairman

Committee on Office Equipment Compiles Helpful Information

THE Committee on Mechanical Office Equipment will hold a meeting at Atlantic City, N. J., in conjunction with the sessions of the Accounting Section during annual convention of the American Gas Association in October. The date of this meeting will be announced later.

While the work of the committee will embrace five separate reports, its chairman, Herbert A. Ehrmann, of the Midland United Company, Chicago, announces that a great deal of emphasis will be placed on presentation and discussion of a large number of unusually efficient accounting methods, short cuts and innovations that result in improved quality of work and the saving of time and labor.

The committee, in one of its reports, has assembled upward of fifty separate methods and procedures of this nature and to these methods applied the term "Wrinkles"; these will be discussed at the meeting.

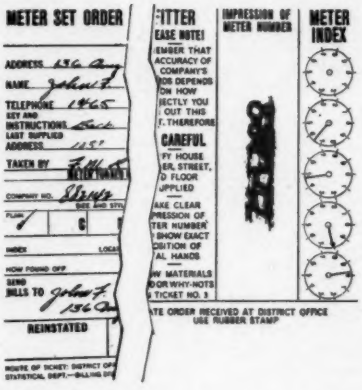
Wrinkles which the committee has selected for presentation cover virtually every phase of accounting—customers' billing and accounting, accounts payable, stores and payroll accounting, form design and preparation and a multitude of miscellaneous office efficiencies which can be applied in various departments. They have been culled from a great variety of devices and methods.

Many of the wrinkles described in the report have to do with the application of mechanical office devices. Others are the result of improved methods of performing manual operations and improved form design. Still others feature simple but effective schemes that improve and speed up office routines and consequently reduce clerical costs.

Incidentally, the chairman points out that this is the first year that wrinkles have been exploited on this scale and in such detail. It is believed that the presentation will afford interest in all divisions of gas utility accounting.

To be specific and give a definite idea of what certain of the committee's wrinkles embrace, two wrinkles of the selected list are summarized here.

This prevents the insertion of incorrect meter numbers on the work tickets by service men and as a consequence eliminates



Impression of meter number on work tickets

expense incurred in sending orders on the street a second time to verify meter numbers.

At the time a "Turn On" and "Turn Off" man or fitter calls to execute "Install," "Remove," "Change," "Turn On," or "Turn Off" orders he obtains an impression of the meter number on his order in the space provided on the order for this purpose. This is accomplished by placing the order against the meter badge so that the space for "Impression of Meter Number" will be directly over the meter number on the badge and by rubbing a finger, pencil or crayon over the meter number.

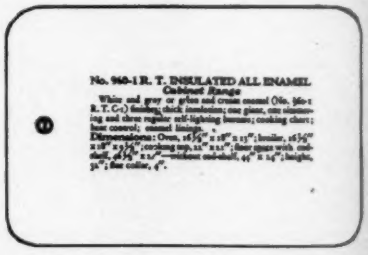
Besides reducing the number of orders issued to verify meter numbers, this "Wrinkle" prevents errors from creeping into office records and brings to light existing errors.

This plan is further applicable to meter test and repair records used in the meter repair shop.

If the paper used is too heavy to receive the impression as outlined, the same result can be accomplished by using a piece of pencil carbon in reverse position. In this plan a small roller is used to effect penetration. The impression, however, is imprinted backwards.

Appliance, Style & Number
ORIOLE 960-1 R.T.
Installment Selling Price $119 00
First Payment $ 11.90
9 Monthly Payments of $11 90
WITH YOUR MONTHLY BILL
Cash Selling Price $112.25

Tag for merchandise on display



The sticker

This exhibit is a tag to be attached to merchandise on display on the sales floor. The tag contains the usual information; style, number, cash selling price, installment selling price, first payment, number of monthly payments and amount of each.

A sticker is pasted to the back of the tag, which contains information descriptive of the article to which the tag pertains. This enables the sales person to explain the details of the merchandise more fully to the customer.

The unusual feature is the celluloid case in which the tag is placed. Dust and fingerprints can be readily wiped off this celluloid cover. The tag remains clean and legible at all times.

The "Wrinkles" phase of the committee's work, of course, embraces a great variety of specific method and detail.

Note—The Committee on Mechanical Office Equipment will welcome expressions from readers about the benefit of the information contained in the above article, especially whether they would desire further data of a similar nature.—The Editor.

Commercial Section

SAMUEL INSULL, Jr. Chairman J. W. WEST, Jr., Secretary WALTER C. BECKJORD, Vice-Chairman

Advance Abstract
Report of Subcommittee on Circulating Heaters

By E. C. Adams

Chairman,
Subcommittee on Circulating Heaters

FOLLOWING are primary conclusions reached by the Subcommittee on Circulating Heaters:

1. The circulating heater potential market for the next ten years will be a most attractive field for the expansion of gas service.
2. The present market is stagnant, because of lack of proper sales effort.
3. Competition has been increasing its effectiveness each year since 1925.
4. New competition from oil circulators, thermostatically controlled, is about to become evident.
5. Unless effective steps are taken to organize proper sales effort, the gas industry cannot expect to show progress in this field.
6. The value of space heater load is usually underestimated.
7. Its importance will become evident as natural gas service expands.
8. The first year's effort on a new program to gain volume sales will probably involve a merchandising loss.

In surveying this subject, the wide variation of conditions in natural and manufactured gas districts must be recognized. On a heat value basis, the gas load per customer is greater in natural gas districts in a proportion of about 3.2 to 1 over manufactured gas districts. This large excess is accounted for in a large degree by the immense space heater use in natural gas districts.

Circulating heaters do not have any past history of consequence, and in order to develop merchandising trends, it is necessary to refer to other types of space heaters. For the purpose of clarifying the terms used in this report the following are definitions:

Space heaters are all heaters, other than central heating plants, used for heating one room or a section of a home. Gas steam radiators are space heaters, but as they have not been sold by the same method as other space heaters, and as this report deals largely with merchandising, no reference is intended to apply to them.

Circulating heaters are those heaters which incorporate an outer shell around an inner unit, in order to accelerate the rate of heat transmission to air, and to more definitely direct the air circulation in the space to be heated.

Space Heater Distribution

Until comparatively recent years, the distribution of space heaters in natural gas districts has been carried on aggressively by manufacturers, distributors and dealers.

This sales effort has followed the expansion of natural gas, and has been to a large degree responsible for the immense natural gas load that has been built over a period of many years. Since natural gas companies started to aggressively merchandise appliances, the burden of building space heater load has been swinging over to gas companies in an increasing degree each year, and now that trade efforts, due to reasons discussed later herein, have fallen off to a point where to a large extent, they may cease to exist unless corrective measures are taken, the responsibility for building space heater load must be assumed as a major sales activity by natural gas companies. As the need for this activity has not existed up until now, the movement of accepting this responsibility has been very slow.

Practically the opposite is true of manufactured gas districts. Because of the operating cost, dealers in these districts have never developed much sales interest in space heaters, consequently, the gas organizations have always accepted space heater load responsibility but only as a minor activity.

Facts that are developed further on in this report, indicate that the space heater field must be extensively developed in order to obtain the maximum domestic use for gas.

The trends that have developed nationally, indicate surely, that competition is reaching into this field far more effectively than is the gas industry, and that effective steps must be taken, if the gas industry is to progress in this field to the extent that conservative sales analysis determines as logically belonging to gas service.

Competition

The principal active competitor has been the porcelain enameled coal-fired circulator, which first obtained prominence by national advertising in 1925. The rapid increase in the distribution of coal circulators would not have been possible without adequate product prices at the beginning and continuing to the peak of the demand, which permitted the expenditure of approximately one million dollars on "Saturday Evening Post" advertising and about double that amount on other desirable building advertising of a supplementary nature. The annual sales of this type of coal-fired unit follow:

	1924	—	30,000 Units
	1925	—	51,000 Units
	1926	—	112,000 Units
	1927	—	222,000 Units
	1928	—	353,000 Units
	1929	—	522,000 Units
	1930	—	360,000 Units
(Estimated)	1931	—	200,000 Units

Much difference of opinion exists in the gas industry as to whether or not the enormous increase in the sales of coal circulators since 1925 is causing loss in the existing space heater gas load. No accurate surveys have been made to determine the extent of the use of coal circulators by customers formerly using gas for heat, but investigations by manufacturers among dealers having extensive sales of coal circulators, indicate that in many natural gas districts, the use of coal circulators has superseded the use of gas space heaters to a degree that should cause concern. In natural gas districts, where coal is in general use, these heaters have had extensive sale and one of the most forceful sales arguments generally used has been that they produce a "dry heat." Such a sales talk indicates that the competition has been, to a large extent, with unvented gas heaters.

In the five-year period from 1925 to 1930 inclusive, 1,569,000 of these coal units were sold. As far as can be determined by the judgment of executives familiar with the distribution of these heaters, at least 50 per cent were sold to consumers having gas service. The heat capacity of these units should not be confused with ordinary gas room heaters, or with heating units for auxiliary service. They are units with heat capacity for about three rooms and are used continuously during the heating season as the only heat in the home.

The recent awakening of the bituminous coal industry to the value of sales work in their industry, and the detail organization work now going on under the direction of the "Committee of Ten" is clearly indicative that the gas industry must prepare for more intensified compe-

tition from bituminous coal and its affiliated manufacturers and sales allies.

In certain metropolitan areas, the results of this awakening are already apparent in the form of the appearance for the first time, of very attractive bill boards depicting the use of coal for fireplaces.

Oil burners in space heaters up until now have been a minor competitive factor. During 1931, in New England their use in competition with gas became more evident. In many cases conversion oil burners were used in coal heaters, but the principal use has been for heating in connection with combination coal and gas ranges. Some idea of the aggressive action of this competition is obtained by the increase in the production of conversion oil burners other than those used in central heating plants. In 1930 the production was 76,000 units. In 1931 the production was 148,000 units, or an increase of almost 100 per cent. Contacts with manufacturers of this type of oil burning equipment indicate that this competition will become even more aggressive where gas rates and coal rates are favorable for oil competition.

The production of fuel oil heating stoves and fuel oil circulators increased about 10 per cent in 1931, that is from a total of 39,413 in 1930, to 43,354 in 1931.

Undoubtedly 1932 will witness considerably increased activity in the sale of fuel oil circulators, for at least six manufacturers are scheduled to announce and aggressively merchandise, attractive fuel oil circulating heaters equipped with thermostatic control.

The Present Market

The volume of sales that is readily obtained by the display of gas circulators and by the usual sales methods in vogue for space heaters, has been so low since gas circulators made their appearance that many gas merchandising men have come to the conclusion that the gas space heater market, for sales in volume, is a thing of the past. Certainly the response obtained in sales efforts on gas space heaters in recent years would indicate that such is the case, if the problem is not analyzed properly and the real cause of the lack of public interest in gas space heaters is not determined.

To determine the present lack of market for gas space heaters in districts where gas has competition from other fuels, you must trace the history of gas heaters through their merchandising cycle since radiant heaters became a factor.

This type of heater had a seven-year period of desire building sales activity; that is, a period of specialty selling where the entire sales story consisted of desire being created by a recital of the service the heaters would give. After general public acceptance was obtained, gas heaters of this type became a football for competitive trade, and price appeal became the generally accepted means for sales. The destructive effects of price appeal only, on a specialty market that is sold in many branches of competitive trade, is well known in scientific sales management circles. L. R. Boulware, a recognized expert on marketing, is the author of an excellent paper on this subject. It appeared in the March 21, 1931, issue of Sales Management under the title "How Price Competition Destroys a Specialty Market." A full knowledge of the merchandising laws that apply to the sales of gas specialties, together with full information on the sales policies in effect for several years, is most convincing evidence that the sales outlets of gas space heaters have just about completely liquidated the market created by the desire building sales effort of the previous seven years.

To be successful over an extended period of time, the sales of such a specialty as gas space heaters, must be guided with very comprehensive understanding of human and economic reactions. The merchandising laws that govern the sale of uncontrolled specialties, that are sold in many branches of competitive trade, are definite and certain; that is, specialties, if their form and service remain unchanged, pass through the various stages of a cycle consisting of:

1. Primary development stage.
2. Stage of desire building sales activity, at a loss.
3. The profitable stage of desire building sales activity and increasing volume.
4. Peak prosperity; volume sales and multiplying outlets.
5. The period when price cutting sales appeal is created.
6. Lowered prices; increased volume, coming from price appeal drives.
7. Still lower prices in efforts to stop the decline in volume; less advertising.
8. High pressure sales tactics by manufacturers to gain volume; carryover stocks. Merchandising loss.
9. Severe decline in number of sales outlets, due to lack of profits and sales interest.
10. Period of stagnation and reconstruction.

The workings of this cycle are quite evident at this time in the electric refrigeration industry. Its laws are certain, but the destructive effects can be minimized by education, organization, and cooperation for the definite purpose of maintaining sound economic balance.

There can hardly be any doubt that space heater merchandising is now in the last stage of the cycle. The depression hastened the end, and the reconstruction period we are now entering is the logical time to start a new cycle. A minority of manufacturers of circulators have already attempted to develop desire building sales effort throughout the industry, but the response to their efforts indicate that organized cooperation of the industry, with complete understanding of the problem confronting the industry is necessary before sales in volume can be developed. Organization, cooperation, and coordinated sales effort in attaining definite objectives should be the order of attack.

One of the most attractive features of the recently adopted A. G. A. dealer cooperative plan and the trade association activities within the Manufacturers' Section, is that both of these activities provide the organization necessary for the centralization of sales thoughts, with consequent reactions that should prevent such complete breakdowns as have occurred in space heater sales channels, in recent years.

While gas circulators have not yet obtained general public acceptance, they are usually sold by the same organizations that sell radiant heaters, consequently they have inherited all the characteristics of radiant heater merchandising.

In the five-year period from 1925 to 1930 more than 6,000,000 new families came into existence (Metropolitan Life Insurance Company, Department of Business Research) and new needs for space heaters developed accordingly. While these new families may be familiar with the shape and form of gas heaters, they have not had the stimulus of a sales story, and they do not have any urge to buy our products. Some few of them will buy because it is the custom of the community, but unless we constantly sell in the full sense of the word, we cannot expect to obtain sales in volume.

It is certain that it will not be economically possible to again stimulate public desire on the older types of appliances beyond the occasional sales stage. Appliances having new features offering new services are essential to produce sales in volume. Such heaters have been developed but, because of the extent of the breakdown in the merchandising structure of other space heaters, they cannot hope for satisfactory public acceptance without unusual cooperation between manufacturers and sales outlets.

In proportion to the known potential market, the present demand is a serious reflection on the sales management of the gas space heater industry and distributing channels. If we are content to leave desire building sales effort to chance neighborhood contacts between our prospects, and the older element who have had experience with gas space heaters, it is hardly possible that public desire for gas service in this form will ever attain any degree of intensity beyond the occasional sale stage. This kind of demand will not support sales effort, consequently if the industry does not correct present sales methods, the great bulk of the house heating load possible to obtain during the next five years, will be lost to some other fuel.

The Potential Market

It is generally conceded that the largest market for the future expansion of domestic gas service lies in the house heating field. The present stage of our sales program is such, that most visions of house heating consist of a central heating plant with an occasional space heater as auxiliary equipment.

While the enormous sales of space heaters using competitive fuels have been

noticed and talked about, no effective organizations have been created in an attempt to obtain a reasonable portion of the circulating heater load. House heating sales programs have usually been developed from the basis of the total of central heating plants in existence. It is possible that the gas industry does not fully realize just how extensive the space heater market really is.

Statistics on this phase of market study are meagre, but a review of Pittsburgh conditions is available through the courtesy of the Equitable Gas Company. In 1924 a typical cross section of the city involving a total of 47,000 inspections was blocked out and contact maintained over a period of years. From this impressive total, percentages of various phases of house heating were determined as being accurate for the entire city. From this survey it was determined that of the total number of dwellings at the end of 1924, 72.1 per cent had no central heating plants and consequently had to depend on some kind of space heaters. At the end of 1926, the percentage had dropped to 65.98 and at the end of 1928 there was further decline to 63.83 per cent. To most executives not familiar with mass housing conditions this high percentage in a district where the heating season extends over seven months, is a revelation.

There are no accurate statistics which show the proportion of space heater dwellings to dwellings having central heating plants, but in every district investigated that has come to our attention, the percentage of homes not equipped with central plants is surprisingly high. The latest survey of the members of the General Federation of Women's Clubs showed that 51.3 per cent of their homes were heated with space heaters. In considering this figure it should be remembered that the members of these clubs represent a living standard that is considerably above the average.

It seems reasonable to assume that people progressive enough to join women's clubs are progressive enough to want the convenience and comfort of gas heating when it is properly presented to them.

It is the popular opinion that space heater homes are characteristic of rural districts and closely congested industrial districts only. The survey of the women's clubs should be effective in dispelling such a belief, for not many of the members of women's clubs reside on farms or in closely congested industrial districts.

Pittsburgh conditions should not be radically different from any other large city with similar climatic conditions, as it has been extremely prosperous and could afford to use central heating plants as extensively as any other city. The Pacific Gas and Electric Company value space heater load highly, as is evidenced by their booklet on circulating heaters, which states that about 60 per cent of their 432,000 domestic consumers do not have central heating plants.

Just what proportion of the space heater homes in Pittsburgh are heated by gas is not known, but it must be high as space heaters have been sold in large volume in the past years, and the latest available data of the Equitable Gas Company's survey shows approximately two gas heaters per family in Pittsburgh.

A comparison of the heat value of the gas consumed per domestic customer in Pittsburgh with the records of other large cities is convincing evidence of the value of space heaters in selling gas, and is valuable in visualizing gas volume possibilities in districts where natural gas is scheduled to be utilized.

It is well known, however, that coal circulators have been sold in very large volume in Pittsburgh and that there must be many in use. This use of bituminous coal in the face of a 60-cent gas rate, demonstrates the extent of effort that must be exerted to keep the public gas minded. It is well known in trade circles that in Pittsburgh, coal circulators have outsold gas circulators to a degree that is hard to understand, without the knowledge that there was a complete absence of sales effort on gas circulators in dealer's circles, and no adequate organization in utility circles for their sale. The field for gas circulators in other large northern cities must be considerably larger than it is in Pittsburgh, because Pittsburgh has attained more complete acceptance of gas heating than any other large city where coal is so strong a competitor.

Many merchandisers question the economic soundness of attempting to gain the space heater market for gas heat because of the financial limitations of the class that live in space heater homes. It undoubtedly is true that cost of operation will determine the degree of acceptance to some extent, but if we have courage enough to attempt to supersede the use of coal in the cellar, we should not be afraid to tackle the job of superseding the use of coal in living quarters.

Certainly other industries are not developing their sales programs with any intention of ignoring the great bulk of the potential market, but on the contrary are becoming more convinced every day that profits of the future depend to a large extent upon the ability to create desire for better living conditions in the volume class.

In commenting on the 7.7 per cent increase in the distribution of electric energy to ultimate consumers in 1931, *Business Week* says:

> "This steady increase in domestic use of electricity during the worst depression years, is the most encouraging detail in the utility picture and contains valuable suggestions for all business men. It indicates that householders will continue to use, and will increase their use of, anything that effectively meets their real needs. Despite wage cuts, part time jobs, and other depression terrors, they insist upon better home lighting, upon mechanical refrigeration, electric ranges, vacuum cleaners, radios, and all the many other convenient devices, which only incidentally, use electricity. The important part seems not to be that electricity is popular, but that the demand for better home living conditions is ever increasing."

The gas industry cannot postpone this sales job with any assurance that it will always remain an open market to be sold when convenient. The success of the coal circulator is convincing proof that the space heater potential customer was dissatisfied with some kind of heating appliance that had been in use, and there is always the danger that some competitor will tie up this field so tightly that we will be shut out.

There can hardly be any doubt that the present readjustment of income will cause sectional heating of homes to become more prevalent because it is more economical. It will also slow up the trend to equip all dwellings with central heating plants.

New suburban districts are not particularly favorable fields for circulators, but the market in cities of the older class is so extensive that any discussion of the saturation point at this time appears unnecessary.

It appears obvious that a great many of the masses of today will evolve into the luxury class of tomorrow and that the gas industry should not delay educating and accustoming the public of all classes to the use of gas as a heating fuel.

For the greatest progress in selling a service of the nature of house heating with gas, it is necessary, in this highly competitive era of competition between industries, to organize sales effort and actively follow through on an industry basis. Certainly, team work with sales policies clearly defined will attain success for the industry far beyond the possibilities of the conflicting independent action that has prevailed.

The Manufacturers' Section is now organized and functioning in divisions of groups of appliances. It appears logical to suggest that basic principles of nationwide sales policies should be prepared for the guidance of the various groups, and that every effort should be made to maintain the industry's sales policy. Unless the largest portion of sales outlets are united in a comprehensive campaign to gain public acceptance, no progress of substantial volume can be expected.

There is no doubt that space heaters now occupy a position of minor importance in the sales program of the industry all out of proportion to their importance as indicated by an impartial study of past and possible future gas sales.

When the need for intense sales effort is so apparent in this particular field, the leaders of the industry should not wait for the forces of economic adjustment to bring about the necessary action. By taking the initiative now, maintenance and expansion of gas sales in this lucrative field will be far easier than if competition is permitted to make such head-

way that dislodging it will be more costly.

To supplant 10 per cent of the domestic use of bituminous coal with gas is not an impossible or impractical goal for the industry. To appreciate what a creditable showing such a small percentage of change would make in expanding gas heating sales, it is only necessary to realize that this would mean double the number of gas-fired heating appliances now on the lines. This means both central heating plants and about 5,000,000 gas space heaters now in use.

When the gas industry fully realizes that most of these 5,000,000 gas-fired space heaters were sold in dealers' channels, and that dealers' sales efforts are now so deplorably weak that they cannot be figured as equal to the task of even maintaining the present volume of house heating gas sales, it is very evident that leadership in sales action by the gas industry is a matter that vitally concerns its progress.

At the present time the sales program of the industry is grossly inadequate to maintain or build in the space heater market and the urgent need for immediate and intensive action is obvious to anyone who is fully informed on this particular phase of the gas industry.

The importance of space heater gas load varies greatly with localities, therefore, no general plan of action is suited for all. This committee recommends that the executives of all gas companies carefully survey their space heater load, both present and potential, and that action be taken to keep the possibilities of load building in this market active in the thoughts of those responsible for increasing the sale of gas. The great fault that has crept slowly into the gas industry is that of permitting the gradual decline of the sales effort outside of the gas industry, which built most of the present immense space heater load. The industry cannot permit a continuance of existing conditions without involving failure in one of the most logical markets that exist for the use of gas at this time.

Even under ordinary conditions corrective action would be imperative, but we face the greater need for building gas load caused by loss of revenue by electric competition in cookery; lowered rates brought about by economic conditions and political pressure, and lower rates due to natural gas utilization. Right now is the proper time to prepare for the burden of these new conditions.

Consumer Acceptance

The circulating gas heater is a comparatively new type that has been developed to fill a very distinct need, based on extensive experience with other types of gas heaters. During the past three years, various attempts have been made to obtain public acceptance of the circulating type, and the failures encountered have been reflected in the improved designs of the latest models.

With the appliances now available and with proper sales and service organizations, the industry should be able to develop a high degree of consumer satisfaction. Appliances are available that develop efficiencies within less than 10 per cent of the ultimate theoretical efficiency; designs are attractive; product prices are at the very lowest possible point based on present volume; therefore all essential elements are present to insure success of sales effort.

As sales effort increases and the market develops, consumer acceptance will grow stronger and stronger, manufacturers will be encouraged to more intensively develop products, and consequently the momentum toward the distant saturation point will continue to increase.

Consumer acceptance in these days is the product of sales effort and therefore cannot be attained previous to the expenditure of sales effort.

Reasons for the failure of some early attempts to sell gas circulators in large volume and to keep them sold are of interest and instructive.

The first gas circulators were copied from coal circulators. Many were installed by people not familiar with gas heater design, and consequently were connected with flues in such a manner that there was excessive draft through appliances. This resulted in poor performance and high gas bills, and caused many appliances to be returned to dealers.

Soon, so-called "down draft diverters" became generally used, which eliminated this problem to a great extent; however, lack of knowledge of the appliances is still a problem of the industry. Not many service men realize that draft diverters serve a more useful purpose in preventing excessive pull on the appliance, than they do in preventing occasional down drafts from interfering with the combustion.

Another common cause of complaint was the lack of quick heat from a cold start. Not much educational work has been done to convince consumers that little is gained by shutting off a gas heater completely overnight, which permits walls, floor and room furnishings to reach such a low temperature that they absorb great quantities of early morning heat capacity. The use of radiant heat in gas circulators is effective in producing quick warmth, regardless of air temperatures, and eliminates such complaints.

Another extensive cause of complaint has been "cold floors" and in this case also, radiant heat is useful in providing a limited area where floors are positively warmed.

Many sales of circulators did not remain sold because of the tendency of the industry to follow the policy established in selling central heating plants; that is, to attempt to heat a dwelling, evenly in a number of rooms, and in some cases in as many as seven rooms, from one circulator. It took some time for the industry to learn that the limiting factor in the capacity of a circulator is the ability to circulate warm air currents through doorways and into various rooms without too great air circulating velocity. It is obvious that you cannot select a size to heat a given number of rooms without regard for the absence of ducts, yet many attempts are made to do so with large capacity gas circulators with exceptionally high velocity of the circulated air. These heaters usually extended quite a distance above the floor line and large volumes of heated air contacted the ceiling. The result was a badly discolored ceiling within a short time, and acute dissatisfaction on the part of the user. Apparently, the high velocity of the air currents to the heater and the excessive pull from around baseboards, etc., increased the dust content of the air abnormally and created drafts at floor level.

Another common cause of dissatisfaction was the lack of "spot heat" which is usually associated with space heated homes, particularly coal-fired space heaters. There have been numerous occasions in gas heating circles when the so-called "huddle system" of heating has been ridiculed, but a serious study of the problem of selling gas to the space heater market, indicates that ridicule of the common habit of users of space heaters to congregate around a stove is not justified.

Every heating engineer knows that there is a difference of from 4° to 8° between the breathing line and floor level, in the best heating systems, and practically everyone realizes that it is extremely comfortable to relax before a radiating fire even though the entire room has a temperature of 72° at the breathing line.

Taking into consideration the trouble encountered by high velocity circulation and the desirability of "spot heat," the conclusion is reached that the most universally desirable unit for residential use, will probably be a heater that provides moderate velocity circulating heat and radiant heat. Heaters without radiant heat are useful in many places, however, and this report does not desire to create the impression that such designs do not serve a very useful purpose in the industry.

In the discussion of these experiences, A. C. Crandall of Southern Cities Public Service Company, Atlanta, coined the term "sensible efficiency," which adequately describes the ability of an appliance to produce heat in a manner that is apparent to the householder through the physical senses of sight and feeling. The higher the "sensible efficiency" of an appliance, the less danger exists of complaint of excess gas bills on the claim that the heat was not used.

To produce a high degree of consumer satisfaction with gas circulators, a full realization should prevail of the need of practical economy for the customer. Gas circulators will not circulate heat any better than will coal circulators, and the degree of comfort that coal circulators give to their users is usually satisfactory to them. Attempts to sell gas circulators

on the claim that they will heat more space are ill advised and unnecessary, as there are many other reasons why gas circulators are more desirable.

A policy of added heat not necessary to please the customer means the expenditure of more money than necessary to give the customer the standard of comfort to which he is accustomed, and less likelihood of a large volume of users and continued sales. The living habits in space heated homes have been so well established that it will be unprofitable to attempt to change them, and there is no real need to change them.

The degree of public acceptance possible to attain by sales effort will vary approximately in proportion to the difference between the cost of operation with gas, and the cost of operation with a competitive fuel. Gas can concede a substantial difference in cost of operation and still obtain the largest portion of the market, but gas rates will have a very important bearing on the ultimate sales results.

Where a gas heating rate is in use, this committee recommends that any dwelling that utilizes gas exclusively as a heating fuel should have the benefit of the heating rate with minimum limitations to insure that the industry will not be compelled to make uneconomical installations.

In changeovers to natural or mixed gas, it seems logical from a study of the value of increased load per customer, to extend every possible inducement to obtain house heating customers.

There are comparatively few localities where gas heating will be cheaper than the competitive fuel in use, but when we study the luxury habits that the American people have developed into every day necessities, any lack of courage that prevents approaching this market with confidence is entirely unjustified.

In this era, the value of a service is now determined by the public without regard for cost, as long as the cost does not exceed the limits of their income available for such service.

The space heater public will accept gas circulators purely with regard to how great is their desire for the added advantages of gas heat. Not only will the value of gas heat in circulators be determined by how intensely the public wants this individual service, but its attractiveness will be measured with other services of an entirely different nature, produced by other industries.

The industry must realize that we are approaching the point where profitable volume can no longer be obtained from satisfying basic needs, but we must establish the industry on a basis, where everyone realizes that volume sales are dependent on our ability to please people in a way that raises their standard of living.

We have every essential material element necessary to do this in the space heater market, but only organized and aggressive sales effort can attain consumer acceptance in a market that is not suffering from actual discomfort, and which will not seek us to buy our products.

AUTHOR'S NOTE—Because of the limitations of space in this publication, the chapters titled "Sales Plans," "The Dealer's Position," "Automatic Operation," "Venting and Installation," and "A Record of Performance" are not included.

A graphic chart showing actual conditions in a space heater home over a 30-day period is a part of the complete report. This record and many uncharted records show that it is possible to furnish highly satisfactory sectional automatic gas heating of homes on a fuel cost basis whereby 10,000,000 B.t.u. of gas consumption is equivalent to one ton of hand-fired bituminous coal. Theoretically, the gas appliances operate on an average net efficiency of 75 per cent, while the net efficiency of the hand-fired bituminous coal is 30 per cent on a heat value content of 25,000,000 B.t.u. per ton.

Close observation and records of a number of installations have convinced the author that when unavoidable excess heat over desired room temperatures is considered as waste heat as it should be, not more than 30 per cent efficiency in useful delivered heat actually exists in the average hand-fired domestic heating plant using bituminous coal. On anthracite or coke the efficiency is higher due to the very small proportion of hydrocarbons in such fuels which results in less overheating.

In many natural gas districts such operating efficiencies place gas heating on a fuel operating cost basis equal and in some sections lower than the cost of solid fuels.

The economy and customer satisfaction with sectional gas heating of homes suggests the thought that this form of heating is also sound and practical for the great mass of small homes having coal-fired furnaces. Sales should be made as automatic auxiliary heating to eliminate the use of coal in all except the most severe cold periods. Such a method of selling gas heat permits the customer to gradually sell themselves on the satisfaction and low cost of automatic gas heat, and in many instances the ultimate result will be that the coal furnace will take the position of the auxiliary unit for heating during severe cold periods only.

Bakers Require Clean Fuel

THE modern baker's aim is to produce a well-baked loaf of bread of the best quality at the lowest cost per pound of production. Therefore he must have a fuel that is economical and affords the maximum of that cleanliness so essential in modern food production. That fuel is gas. It has automatic control that insures minimum consumption. There is no labor cost in maintaining temperatures. It spreads no vapor or ash and leaves no unconsumed residue. No other fuel is as clean.

A. G. A. Pamphlets on Safety Available

Pamphlets giving recommended safe practices for the gas industry, as prepared by a joint committee of the Technical Section and the Accident Prevention Committee of the Association are now available in Lefax size and form on the following subjects:

1. Suggestions for the Safe Operation of a Water Gas Plant.
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Orders should be addressed to the Secretary, ACCIDENT PREVENTION COMMITTEE,

AMERICAN GAS ASSOCIATION
420 Lexington Avenue
New York, N. Y.

Home Service Committee

HULDA UNGERICHT, Chairman — JESSIE MCQUEEN, Secretary

A. G. A. President Calls Home Service Workers Good Will Builders

R. W. Gallagher

THE combined "Course in Domestic Gas Appliances" and "Home Service Conference," sponsored by the American Gas Association Home Service Committee, took place in Cleveland at the Testing Laboratory, June 15 to 17, with a total enrollment of 105. This list comprised representatives of home service departments, gas company sales developments, representatives of manufacturing companies, teachers, and editors of women's magazines. The two and one-half day program included a study of domestic gas appliances, the lectures and laboratory work being presented by members of the engineering staff of the Laboratory. In addition to the operation, care and adjustment of appliances, lectures were given on the subjects of "What Home Service Workers Need to Know about Gas"; "Comparison of Gas and Electricity"; "How Variables in Different Forms of Gas Effect Appliances" and "Flues and Ventilation." Considerable time was given to the actual adjustment of appliances, participated in by members of the course and in charge of a group of the engineers. A trip through the Laboratory was likewise an interesting feature of the course.

Among the Home Service talks were discussions on "Home Service Trends"; "Contacts with Women's Clubs"; "Home Service and Advertising" and "Load Value of Kitchen Planning," most of these subjects being discussed by home service directors.

The subject, "Building Greater Load Through Home Service," was effectively presented by Hugh Cuthrell, new business department, The Brooklyn Union Gas Company. "Intangible Advantages of Home Service" was the topic ably presented by E. M. Tharp, assistant general manager of the Ohio Fuel Gas Company.

The program was especially strengthened by talks on merchandising problems. The subjects "Surmounting Domestic Competition," by F. M. Milward Oliver, vice-president of the Philadelphia Gas Works, and "Merchandising Gas Appliances," by N. J. Griffith, president of the Somerville Stove Works, were discussed by Mrs. Bernice Bowser, of the Bowser Service Corporation.

Probably the high light of the conference was the dinner meeting held on Wednesday evening at the Hollenden Hotel with eighty-five present, the arrangements (including music) being cared for by the East Ohio Gas Company through the services of Mrs. Flora B. Fry, home service director. Miss Hulda Ungericht of the Columbus Gas and Fuel Company and chairman of the Home Service Committee, presided, introducing the speakers, who were R. W. Gallagher, president of the American Gas Association and president of the East Ohio Gas Company; Miss Katharine Fisher, director of Good Housekeeping Institute, and Earle W. Hodges, director of public relations, Henry L. Doherty & Company. Mr. Gallagher said:

"I am honored indeed to have been selected to welcome you here tonight. I think it is a great tribute to the Home Service Department that member companies have sent so many of you here to this meeting. All the sectional meetings which have been held recently have had less attendance than at any other time

Group Attending Course in Domestic Appliances and Home Service Conference at A. G. A. Testing Laboratory, Cleveland, Ohio

during recent years, so that when the management of your company picked you as their representatives to come to this meeting they surely must have had in mind that their home service department is not only desirable but necessary to the company.

"A few years ago I was asked to welcome a similar group and at that time the attendance was so small that it developed into a round table meeting and I assumed tonight that I would be privileged to talk to some twenty or twenty-five people around a large table. I am amazed and greatly pleased to see so many here.

"I understand that you are having very excellent meetings at the Laboratory, which is to be expected, as Mr. Conner and his assistants are certainly qualified to give you the information which the home service department needs. And before going further, I want to pay tribute to Mr. Conner and his assistants for building up a laboratory for the gas industry which is nationally known and nationally recognized.

"To show how the home service department has grown, I think it was in 1923 when there were only 14 companies which had such departments in their organizations. Today I understand from Mr. Conner that there are 367 gas companies and manufacturers of appliances which have home service departments. Twenty-five are maintained by appliance manufacturers. This in itself speaks volumes for the need of the work you are doing. Home service departments as I see them are the particular branch of the public utility industry which builds up good will. Gas companies are depending upon them for the contacts which they have with their customers—and I say customers advisedly.

"Some people say consumers—I don't like the word 'consumers.' It is just as necessary for the gas companies and the utilities at large to maintain proper relationships with their customers, if you please, as it is for a department store, and I submit in the past that it was not done, and I submit further that in the home service departments this contact can be maintained; the utility companies can put themselves in the position of meeting the competition they have with other fuels, just as the retailers meet the competition they have from other retailers. Some people think there is no competition in the gas business. I do not need to discuss that question with this body. In the manufactured gas field, your competition is particularly in cooking and water heating. In the natural gas field, it is in house heating and industrial work.

"I believe that you have a great work before you and that you are approaching the problem in the right way when you come here to this institution—the A. G. A. Laboratory—and prepare yourself to meet your customers with proper knowledge of your business. It should not be necessary to review our faults except to say that in the past we have had contact men who were not conversant with the details of the service they were selling. It is only recently that we have come to the realization that it is most important that all employees in a utility organization know the appliances and the commodity they are selling and the service our customers should get from such appliances.

"It is only recently that we have come to the realization that a poor gas range is most certainly a poor beginning for a water heater sale or for the sale of house heating. If we can't sell a good range to the woman who is doing the cooking, you are certainly going to have great difficulty in enlarging your business through the use of additional gas for water heating and house heating. I would like to stress the words 'use of gas.' I suggest that if anyone feels that his or her particular job is only to hold the business we have, they should change their viewpoint and, if this is not possible, make room for someone who has sufficient vision to carry on the work started by the pioneers of the industry. The minute that the gas industry gets to thinking in terms of merely holding the business it already has on its lines, it is going back. As the old adage goes, 'If you are not progressing, you are going backwards,' and this is particularly true in the gas industry.

"When I emphasize the word 'use' in connection with gas I like to think of Dr. Ames, of Dartmouth, who, before entering the University, was a practical business man with a leaning toward education, and after a number of years at Dartmouth he wrote an article in which he stated that the future possibilities of any business lie in research, more research and then more research. In other words, find additional uses for your commodity.

"By looking to such organizations as the Laboratory and the work of the Industrial Gas Research Committee, which have investigations under way on house cooling and additional methods of fitting gas into industrial service, combined with the manufacturers who are bringing out new appliances which are more efficient and which fit into our particular situation, we can bring ourselves to the state of mind, which, I am glad to say, the home service departments already have, that there is business to be had. We then have certainly gone a long way towards getting it on our lines. The next difficulty, of course, is to sell that idea to the organization and that is where the home service departments particularly fit in. They can help the sales departments, first, by invigorating them with fresh ideas of sale possibilities, and second, by putting them in touch with the possibilities of selling gas to the people they come in contact with, so that at this particular time and under these stressed conditions, the home service departments are in a unique position where they can help their companies probably more than can any other department. Of course, we have to know our product—we have to know how to use it.

"The message that I would like to pass on to you is that when you come in contact with people in your organization who do not have the proper knowledge of gas and gas appliances, you should call this fact to the attention of the management. You may have to do it a number of times, but it will finally have its effect. You will be greatly thanked by the management itself."

Following these talks several well-known women in home economics work in Cleveland were introduced and made brief remarks. Included among these were Miss Charlotte C. Greer, author of a number of high school textbooks on foods and head of the Home Economics Department of the John Hay High School; Miss Adelaide Laura Van Duzen, supervisor of home economics, Cleveland public schools; Miss Mary E. Parker, head of the Home Economics Department of Western Reserve University, Cleveland; Mrs. Florence LaGanke Harris, director of women's activities, Building Arts Exhibit, Inc.; Miss Julia J. Kennison, National Broadcasting Company; Mrs. Ruth Meriam Wells, director, Home Institute, *The Cleveland News,* and Miss Helen Robertson, director of the Home Economics Department of *The Cleveland Plain Dealer.*

The registration included enrollments from New England with many Eastern, Middle-West and Northern States represented. Mrs. Pearl Spencer of the San Antonio Public Service Company, San Antonio, Texas, and Miss Mildred Clark of the Oklahoma Natural Gas Corp., Oklahoma City, Okla., represented the Southern States.

The program was the outgrowth of the week's intensive course in gas appliances which has been given at the Testing Laboratory for the past four years under the direction of the Laboratory Staff in cooperation with the Home Service Committee. The course for 1932 was considerably shortened to include a number of the important subjects in this week's course and combine it with Home Service subjects in order to make it of the most worth while value for this year. Enthusiastic endorsements of the combined and shortened course have been received and it is thought another year this same plan of action will be considered by the Home Service Committee.

Those in charge of the course, in addition to Miss Hulda Ungericht, chairman of the Home Service Committee, were Miss Ada Bessie Swann, Public Service Electric & Gas Company, Newark, who, as chairman of the Subcommittee on Educational Courses, was actively in charge of the course assisted by F. R. Wright, publications editor of the A. G. A. Laboratory, who was in charge of arrangements at the Testing Laboratory. Others assisting were Mrs. Flora B. Fry, home service director of the East Ohio Gas Company, in charge of the local arrangements, and Miss Jessie McQueen, home service counsellor of the American Gas Association.

Publicity and Advertising Section

WILLIAM H. HODGE, Chairman ALLYN B. TUNIS, Secretary HENRY OBERMEYER, Vice-Chairman

New Head of P. U. A. A. Former Newspaper Writer

E. FRANK GARDINER, director of advertising and publicity of the Midland United Company of Chicago, and an active member of the Publicity and Advertising Section of the American Gas Association, elected president of the Public Utilities Advertising Association at its meeting in New York in conjunction with the annual convention of the Advertising Federation of America, was actively engaged in newspaper work for approximately twelve years and for the last eleven years has been in the public utility business.

E. Frank Gardiner

A native of Illinois, Mr. Gardiner began his newspaper career in Kankakee, Ill. After about three years of small city newspaper work he went to Chicago. He became city hall reporter for the *Chicago Evening Post* and later was appointed political editor of that paper. Later he went to the *Chicago Tribune*. When James Keeley left the *Tribune* to become owner of the *Chicago Herald*, Mr. Gardiner went to that paper, remaining there until the paper was sold four years later, in 1918, to W. R. Hearst, who combined it with the *Examiner*.

Mr. Gardiner then went to New York with the foreign cable service of the United States Committee on Public Information. When this governmental activity was discontinued at the close of the Peace Conference, Mr. Gardiner engaged in general advertising and publicity work for two years. He entered the public utility business in 1921 and since 1923 has been in charge of advertising and publicity for the Midland United Company and its subsidiary operating companies, which are located in Indiana and Ohio.

Mr. Gardiner has been active in public utility association work for several years. He served two years as a sectional vice-president of the American Gas Association.

P. U. A. A. Announces Winners in "Better Copy" Contest

WINNERS in the annual "Better Copy" Contest of the Public Utilities Advertising Association, for the best newspaper advertisements run during the year 1931, were announced by Eric W. Swift, of Chicago, chairman of the "Better Copy" Committee, at the Association's annual convention in New York. More than 200 companies submitted a total of 3,000 pieces of copy. The awards are acknowledged to be the highest possible for public utility advertising.

Certificates of Awards presented were as follows:

Gas Institutional Division:

First, The Dallas Lone Star Gas Company, Dallas, Texas.

Second, Public Service Company of Northern Illinois, Chicago, Ill.

Honorable Mention, Laclede Gas Light Company, St. Louis, Mo.; Oklahoma Natural Gas Corporation, Tulsa, Okla.; Texas Cities Lone Star Gas Company, Dallas, Texas; Seattle Gas Company, Seattle, Wash.

Gas Merchandise Division:

First, The Union Gas & Electric Company, Cincinnati, Ohio.

Second, Springfield Gas Light Company, Charles H. Tenney & Company, Boston, Mass.

Honorable Mention, Consolidated Gas Company of New York, New York, N. Y.; The Washington Gas Light Company, Washington, D. C.; Northern Indiana Public Service Company, Hammond, Ind.; Pacific Gas and Electric Company, San Francisco, Calif.

Electric, Gas and Transportation Posters Division:

First, Salt Lake and Utah Railroad, Salt Lake City, Utah.

Second, Consolidated Gas Company of New York, New York, N. Y.

Honorable Mention, The New York Edison System, New York, N. Y., Public Service Company of Northern Illinois, Chicago, Ill.

Electric, Gas and Transportation Billboards Division:

First, Pacific Electric Railway, Los Angeles, Calif.

Second, Virginia Electric and Power Company, Richmond, Va.

Honorable Mention, Chicago North Shore and Milwaukee Railroad Company, Chicago, Ill., Jersey Central Power & Light Co., Asbury Park, N. J.

A booklet, containing reproductions of all of the best newspaper advertisements by public utilities, has been published by the Association.

Mr. Blanchard Resigns

FRANK LEROY BLANCHARD, one of the best known utility advertising and publicity men of the country, has resigned as director of the advertising and news department of Henry L. Doherty & Co., New York, N. Y., after a service of ten years. For years Mr. Blanchard has been active in the affairs of the American Gas Association, having served as chairman of the Publicity and Advertising Section and now continues as one of its members. He also is a member of *The Monthly* Advisory Committee.

F. L. Blanchard

In recognition of Mr. Blanchard's activity in public utility advertising and publicity, the Public Utilities Advertising Association at its recent convention in New York, elected him an honorary life member of the board of directors and presented him with a gold watch.

He is a former editor of *Editor and Publisher*, assistant managing editor of the old *Evening Telegram*, editor of the *Morning Telegram*, publisher of the New Britain (Conn.) *Herald*, and a former staff member of *Printers' Ink*. He is author of the book, "The Essentials of Advertising."

Elliott McEldowney, former New York newspaperman and for seven years assistant to Mr. Blanchard has been appointed to succeed the latter.

Have You A New Address?

American Gas Association members who have changed their addresses or positions are requested to notify Headquarters in order that membership records may be kept up-to-date. Copies of THE MONTHLY and other mail matter have been returned because some members have failed to advise the Association of changes in addresses. Delays of this nature will be eliminated if members will write their new addresses on a postcard and address it to the American Gas Association, 420 Lexington Avenue, New York, N. Y.

Testing Laboratory
R. M. CONNER, Director
MANAGING COMMITTEE
J. S. DeHART, Jr., Chairman N. T. SELLMAN, Secretary

Minimum Requirements for Gas Burning Household Appliances*

By F. E. Vandaveer

CONSERVATIVE estimates made recently have indicated that approximately 90 per cent of all gas burning household appliances sold in this country last year were built in accordance with the minimum requirements established by the American Gas Association. Since the gas range, water heater, laundry stove, refrigerator and other gas burning appliances are such important items in equipping the modern home, it may be of interest to consider very briefly some of these minimum requirements and how they are enforced.

Although they are termed minimum requirements they are purposely made exceedingly rigid so that first of all safety may be assured, and secondly a reasonable degree of durability inseparable from safety, and thirdly a reasonable operating efficiency. Requirements are prepared by subcommittees consisting of representatives from gas companies and appliance manufacturers, and then submitted to a general committee for approval. On this general committee there are representatives not only from the gas industry but also from every interested organization, such as the United States Bureau of Standards, United States Bureau of Mines, United States Public Health Service, Master Plumbers' Association, Heating & Piping Contractors' Association, Underwriters' Laboratories, National Safety Council, Institute of Architects, Factory Mutual Life Insurance Companies, National Board of Fire Underwriters, Canadian Gas Association, United States Bureau of Home Economics, and American Home Economics Association. You may be interested in knowing that Dr. Louise Stanley represents the United Bureau of Home Economics and Miss Alice L. Edwards represents both the American Home Economics Association and National Safety Council on this committee. Following approval by the general committee the proposed requirements are submitted in tentative form to the gas industry at large for criticism and comment. The requirements are revised in the light of these comments and are then submitted to the American Standards Association for acceptance as American Standards so that they become more than standards of a trade association. Copies of any of the printed requirements may be obtained upon application to the American Gas Association, 420 Lexington Avenue, New York, N. Y., or to the A. G. A. Laboratory, in Cleveland.

The testing and inspection of appliances in accordance with these requirements is conducted by the American Gas Association Testing Laboratory in Cleveland, established in 1925, and a branch laboratory in Los Angeles, where testing began in 1931. Both institutions were dedicated to insure the user and the public in general safe gas appliances, assist the appliance manufacturers in producing safe and efficient equipment, improve the art of appliance design, and eliminate forever from the market, at the earliest possible moment, appliances that do not meet proper concepts of substantiality, utility and above all things safety. In addition to the regular testing, a large amount of research on appliances is also conducted at the Cleveland Laboratory, where about sixty people are employed. All testing engineers are engineering college graduates.

After an appliance has passed all tests satisfactorily the manufacturer is granted a Certificate of Approval good for one year. Approval for succeeding years depends upon the passing of a very rigid inspection of production models at the factory at least once each year.

The Laboratory Seal of Approval as well as the name and number of the range and name and address of manufacturer must be placed on all approved appliances in an easily observed location in order to properly identify it. This approval seal consists of a blue star surrounded by two concentric circles within which are the words "Complies with national safety requirements. Approved," and the words "American Gas Association" written through the star. The housewife or purchaser of a gas appliance should be sure this label is attached to it before purchasing. In case of doubt as to whether it is an approved model a copy of the Certificate of Approval can be requested of the dealer or reference made to the A. G. A. List of Approved Appliances, which is published monthly and may be obtained through the American Gas Association or from any gas company or manufacturer member. This list now contains over 20,000 different models of approved gas appliances. It would be of great assistance in this effort to improve gas appliances if school teachers would instruct their pupils, and the buying public in general, knew more about the advantages of purchasing approved gas appliances.

To assist in devising and strengthening requirements, a large amount of research and investigational work is continually under way. For example, tests on gas cocks, surface temperatures of insulated ovens, relief valves, hotel and restaurant ranges, garage heaters, ironers, etc., are now in process. Recently an investigation of cooking and water heating by gas and by electricity was completed, and a bulletin published. It is probably one of the most comprehensive pamphlets on this subject ever printed and is available to anyone on application to the American Gas Association.

With the assistance of the various advisory groups, the entire gas industry and special investigations conducted at the A. G. A. Laboratory, the various committees revise and strengthen the requirements as it becomes necessary and usually new editions are printed once a year. As a result of this program of standardization and establish-

(Continued on page 364)

Dr. F. E. Vandaveer, supervisor of the A. G. A. Testing Laboratory, was one of the speakers at the annual American Home Economics Association Convention in Atlanta, Ga., June 22, addressing a section meeting of the association on "The House." This section is made up of those in the association who are particularly interested in the equipment of the house and comprises teachers of equipment in colleges and high schools, and heads of research departments in both schools and business concerns. Dr. Vandaveer illustrated his talk with slides showing the test work at the Laboratory. Following this meeting, at a luncheon devoted to standardization subjects, Dr. Vandaveer again spoke briefly of the test work. The section meeting was presided over by Dr. Hildegard Kneeland, of the Bureau of Home Economics, and at the luncheon meeting Dr. Faith Williams, also of the Bureau of Home Economics, presided. These meetings were attended by other officers of the Home Economics Association and representatives of the Bureau of Home Economics.

*Digest of address delivered before the Annual Meeting of the American Home Economics Association, Atlanta, Ga., June 22, 1932.

Technical Section

I. K. PECK, Chairman — H. W. HARTMAN, Secretary — J. A. PERRY, Vice-Chairman

Electrical Methods for Estimating the Corrosiveness of Soils

By Scott Ewing

American Gas Association Research Associate

I. Introduction

ECONOMY in the use of protective coatings for pipe lines limits their use to soils which are particularly destructive to buried pipe. The results obtained by the Bureau of Standards from burial tests of pipe materials as well as inspections of numerous pipe lines indicate clearly that soils differ greatly in the rate at which they attack iron and steel. There is need, therefore, for some simple test of the soil which will indicate its corrosiveness, and several electrical methods have been proposed for this purpose. Data from various sources indicate that for some soils there is a rough relation between the electrical conductivity of the soil and its corrosiveness, but that the conductivity method of rating soils is not universally reliable. Aside from the question of the exact mechanism by which metals are corroded by soils, if we are to accept the electrochemical theory of corrosion, we can not escape the conclusion that the corrosion rate should be very nearly proportional to the total galvanic current flowing between the anodic and cathodic areas. If a method could be devised to measure this current or some quantity closely related to it, there is reason to believe that the method would indicate the corrosiveness of the soil.

The present investigation was undertaken with the object of learning something about the accuracy of the various devices for testing corrosiveness, with the hope of improving them. Although the work is still in progress, it seems desirable to publish the results that have been obtained thus far. They may be of assistance to others who are working on the same problem and serve to point out the limitations and possibilities of the present methods.

II. Electrical Tests for Soil Corrosiveness

Descriptions of most of the electrical methods for testing the corrosiveness of soils have been published[1], [2]. In all of these methods current is caused to flow from an iron or steel anode for a short distance through the soil to some form of cathode. A more or less constant potential difference is applied between the two electrodes, and the magnitude of the current is taken to indicate the relative corrosiveness of the soil. In the case of the Shepard earth resistivity meter,[3] in which a potential difference of three volts is used, the ammeter in the circuit is calibrated in ohm-centimeters to indicate directly the soil resistivity, and the circuit is so arranged as to make the effects of all other factors as small as

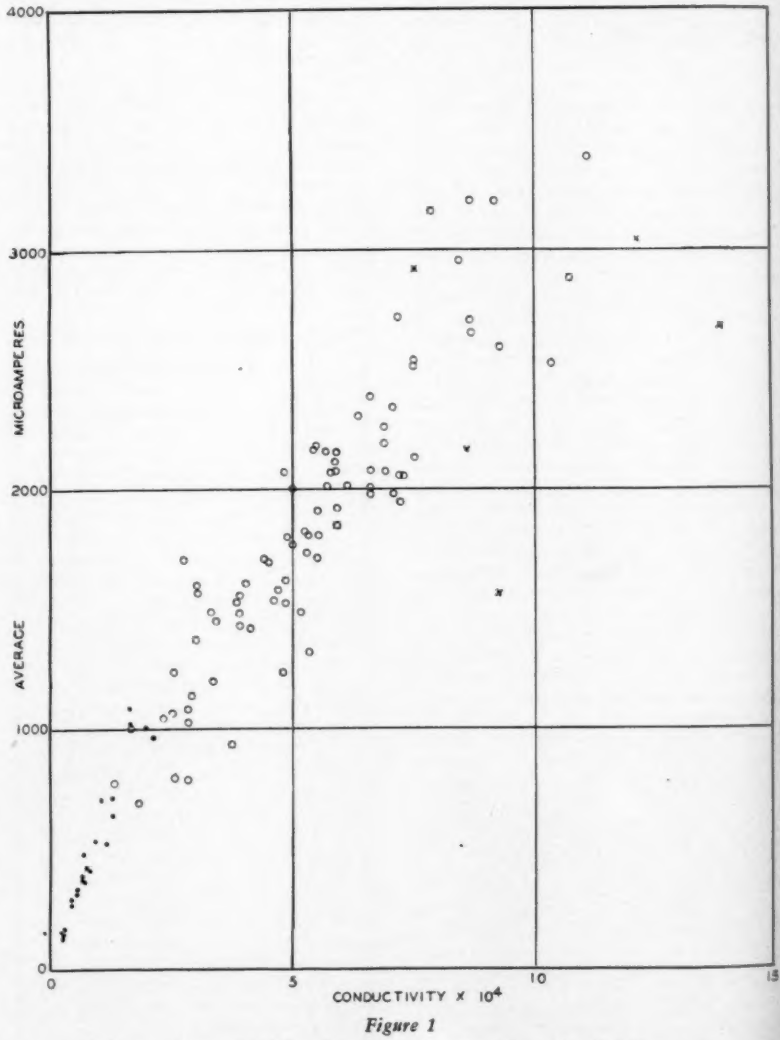

Figure 1

Relation between field measurements of conductivity and galvanic current

[1] Shepard, E. R. Methods for determining the corrosivity of soils. Oil and Gas Journal, *30*, p. T40 (1931).

[2] Logan, K. H. Soil corrosivity surveys. Oil and Gas Journal, *30*, p. 28 (1931).

[3] Shepard, E. R. Pipe line currents and soil resistivity as indicators of local corrosive soil areas. Bur. Stds. Jour. Research, *6*, p. 683 (1931).

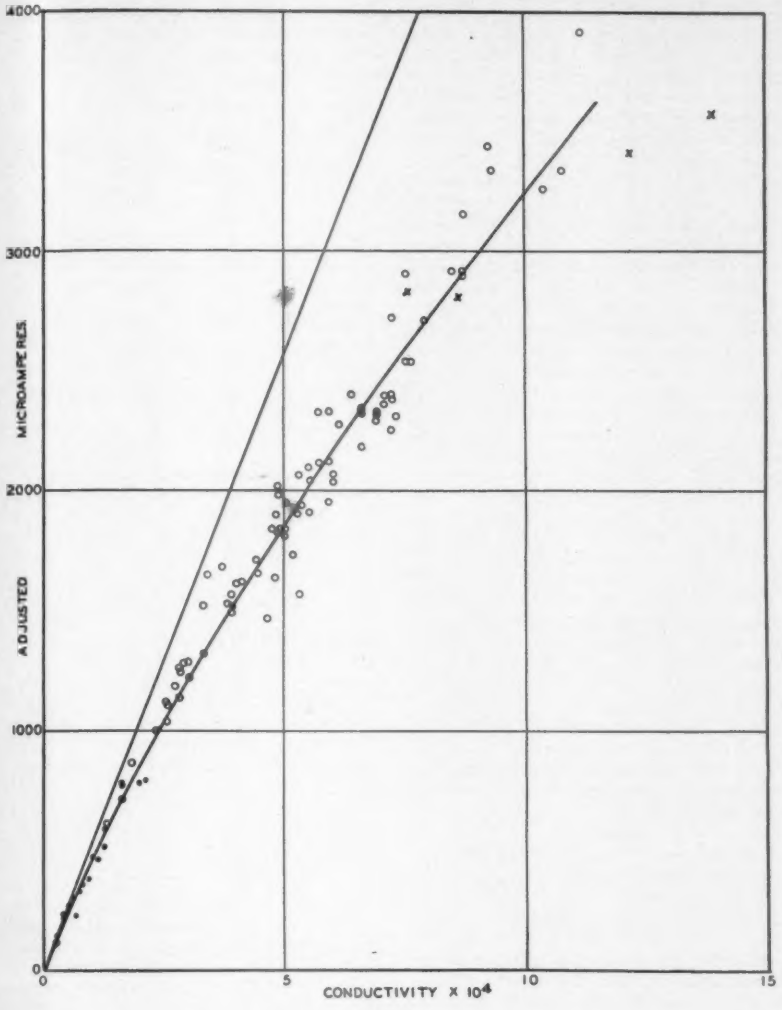

Figure 2

Relation between field measurements of conductivity and galvanic current—potential differences adjusted to the same value

possible. The first sustained reading is the one used. The Columbia soil rod devised by Legg[4] employs one steel and one copper electrode and the galvanic potential between these dissimilar metals constitutes the only source of current, no battery being used. When the rod has been placed in position in the soil, the circuit is closed and the current is read every ten seconds for a period of 40 seconds. The average current is taken to indicate the relative corrosiveness of the soil. In the Putnam method,[5] which so far has been employed only in the laboratory, a potential difference of 1.4 volts is applied between electrodes on opposite sides of a cubical cell containing the soil sample and the current is read after it reaches a steady value. It is similar to the Columbia rod in that it also takes polarization into account. The theoretical argument upon which this method is based is plausible, but the experimental work was unfortunately carried out with alkali soils only. In a laboratory method described by Corfield[6] the corrosiveness of a soil is said to be indicated by the loss in weight of a short piece of pipe, which is connected as anode in a cell containing the soil to be tested and across which a potential difference of 6 volts is maintained for a period of 24 hours.

It is important to consider the magnitude of some of the quantities which enter into the measurement of soil corrosivity by these methods. Potentials which are probably responsible for soil corrosion are usually small. Measurements of the potential difference between mill scale and bright iron, or between electrodes in puddled and coarse granular soil, seldom give values above 0.5 volt. Higher values than this can be obtained, but they do not persist. Potential differences of about 0.1 volt were found by Kuhn[7] between different points on single lengths of cast-iron pipe. Measurements made by the writer and others indicate that for current densities up to one milliampere per square centimeter, which correspondes to a penetration of 0.46 inch in one year, the total polarization on anode and cathode is seldom greater than 0.6 volt.

In testing a soil of moderately high resistivity (1500 ohm-cm) by any of the methods here described, in which the effective distance between the electrodes is at least 3 cm., polarization effects are relatively small, for it is apparent that if a low potential, e.g., 0.5 volt, is applied the high resistivity makes the current density on the electrodes so low that little polarization takes place; while if a higher potential, such as three volts, is applied, the effect of polarization on current flow would be almost negligible. As the soil resistivity decreases the polarization effects become greater in the twenty-four hour Corfield test, the current drops in some soils to only a fraction of the initial value. There are indications that this dropping off is caused by drying out of the soil around the anode, which effect would not enter to any extent in ordinary corrosion. The Columbia rod is affected by polarization to a greater extent than is any other device because of the low potential applied; but this potential is so variable with different soils that the significance of polarization in this connection becomes obscure.

III. Galvanic Currents between Iron and Copper Electrodes in Soil

1. *Results of Field Measurements*

In order to compare measurements of galvanic current and conductivity in soils as indicators of corrosiveness, a field study was made along pipe lines in Ohio, Indiana, and West Virginia in cooperation with the Columbia Engineering and Management Corporation. The apparatus used was the Columbia soil rod, previously described, and a Leeds and Northrup soil conductivity bridge. Readings of current and soil resistivity were made at a number of points of inspection where the pipe line had been uncovered for repair. The conical point of the rod was driven into the trench wall or into an auger hole, the circuit closed through a microammeter and the current read at ten-second intervals. The terminals of the rod were then connected to the alternating-current bridge and the resistance between the electrodes was measured. From the bridge reading and the constant of the rod, the soil resistivity was cal-

[4] Legg, B. B. Early steps in the development of the Columbia soil rod. Gas Age-Record, 67, p. 111 (1931).
[5] Putnam, J. F. Soil Corrosion and Prevention. Oil and Gas Jour. 29, p. 158 (1930).
[6] Corfield, Guy. Running a soil survey. Western Gas, 7, p. 123 (1930).
[7] Kuhn, R. J. Galvanic corrosion on cast-iron pipes. Ind. and Eng. Chem., 22, p. 335 (1930).

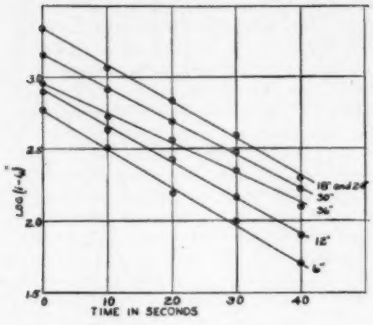

Figure 3

Microampere readings at different depths

culated. By taking the reciprocal of the resistivity, the conductivity of the soil was obtained.

To correlate the readings obtained at the points of inspection with the corrosiveness of the soil, it was highly desirable to know the exact degree of corrosion which had occurred at each of the inspection points. Under the conditions of the investigation it was impossible to obtain such data. However, the pipe line operator would be entirely satisfied if he could divide the soils along the line into three or four classes with respect to their corrosiveness. On the basis of the operator's experience, it was found possible to divide the inspection points into four classes which are described as follows:

Class 1. Small, isolated areas along so-called "sulphur streams" and seepage areas where the soil and water contain a high percentage of soluble material. Bare pipe in these places usually fails within five years. Only three such places were observed.

Class 2. Low, poorly drained, mucky areas of rather limited extent where the pipe life is approximately ten years.

Class 3. The general typical upland soils of Ohio and Indiana. Pipe as old as 25 years is still in service in these soils, but leaks usually begin to appear after about 15 years.

Class 4. Extensive areas, characterized by rough, steep topography, found in West Virginia and probably parts of southeastern Ohio. The pipe in this soil will last at least 30 years and probably considerably longer.

The essential data obtained in this study are shown in Figure 1 in which the average current recorded in 40 seconds with the Columbia soil rod is plotted as ordinate against the conductivity of the soil as abscissa. The character of the soils according to the classification adopted is indicated in the figure except for those in class 1, the values for which are beyond the limits of the figure. Points in class 2 are indicated by a cross (x), class 3 by a circle and class 4 by a large dot (.).

It is evident from the figure that the microampere reading is determined principally by the soil conductivity. The voltage between the electrodes was calculated from the initial reading of the microammeter and the resistivity as measured by alternating current. These voltages varied from 0.24 to 0.61 volt, with an average of 0.43 volt. By using Ohm's law to adjust the microampere measurements to a common voltage (0.43 volt), we can eliminate the effect of the variation in the voltage between iron and copper. These adjusted microampere readings are shown plotted against the soil conductivity in Figure 2. Since the spread of the points in Figure 2 is much reduced, it seems reasonable to conclude that next to the conductivity, the variation in voltage between iron and copper in the soils is the most important cause of variation of the microampere measurements.

The influence of polarization on the values of the microampere readings may be seen in Figure 2. If there were no polarization or experimental errors, all of the points would lie along the straight line shown in Figure 2. The departure from this straight line increases with the size of the current and is a measure of the polarization on the electrodes. The variations in polarization for any given conductivity are probably within the limits of experimental error. The data may be analyzed by other methods but the conclusion is always the same, that the amount of polarization as measured by the decrease in the current is determined only by the magnitude of the current or the conductivity.

By examining Figure 1, one can easily see that either the microampere readings or the soil conductivities separate the decidedly corrosive soils from the practically non-corrosive soils. If there is any choice between the methods it is probably in favor of the conductivity method. The lack of definite corrosion data and the errors of measurement make it inadvisable to draw any more definite conclusions from the data presented.

2. *Normal and Abnormal Time-Current Curves*

In all of the previously described measurements with the Columbia rod there is, within the limits of a reasonable experimental error, a linear relation between the logarithm of the current and the time, which can be expressed by the equation:

$$-\log(i-i_t) = kt \pm C$$

where i_t is the final steady value of the current and i is the current at the time, t. The above equation is obtained by integrating the differential equation:

$$-\frac{di}{dt} = k\,(i-i_t)$$

To show this, a set of measurements made at different depths in the same place is plotted in Figure 3. These results are typical of those obtained in the well-developed upland soils of Ohio and Indiana. In the horizon at 18-30 inches from the surface the maximum microampere readings and the minimum resistivity readings are obtained. In all of the routine field measurements the rod was placed at this depth.

Laboratory measurements of galvanic currents with iron and copper electrodes show that the logarithmic relation of Figure 3 does not obtain in all soils. The well-developed acid soils which have been tested always gave the linear relation, but soils containing considerable soluble material usually did not. The results of laboratory measurements on four different soils are shown in Figure 4. The Fairmount, Susquehanna and Tidal Marsh are acid soils, the Hanford is alkaline. The Fairmount and Susquehanna contain practically no soluble salts, the Hanford contains a moderate amount, and the Tidal Marsh a large amount.

3. *Comparison of Measurements of Galvanic Current and Conductivity with Results of a Laboratory Corrosion Test*

In order to obtain further evidence of a possible correlation between galvanic current, conductivity and corrosion, measurements of the loss of weight of steel specimens in contact with several soils in the laboratory were made for comparison with the electrical measurements. Since the moisture content of the soil has a great influence on its corrosiveness as well as on conductivity and the magnitude of the galvanic current, the test was so arranged that the influence of moisture could be studied also. Soil which had passed a 20-mesh sieve was mixed with amounts of water

TABLE 1

EFFECT OF MOISTURE CONTENT ON GALVANIC CURRENT, CONDUCTIVITY AND CORROSION RATE

Soil	Av. Galvanic Current (40 sec.)			Conductivity × 10^4			Corrosion Rate		
	Saturated	At Moisture Equivalent	At Half Moisture Equivalent	Saturated	At Moisture Equivalent	At Half Moisture Equivalent	Saturated	At Moisture Equivalent	At Half Moisture Equivalent
	microamperes			mhos x 10^4			Oz. per sq ft. per year		
Norfolk sand	50	16.2	—	.235	.0847	—	1.64	.274	—
Cecil clay loam	272	252	3.0	.613	.546	.047	3.30	3.73	.090
Unidentified silt loam	1,460	858	34.8	6.06	5.18	.917	2.06	2.82	.97
Hanford fine sandy loam	2,890	2,094	420	39.5	19.4	7.72	6.44	7.63	4.14
Tidal marsh	10,810	5,316	—	174.0	53.5	—	5.25	5.35	—

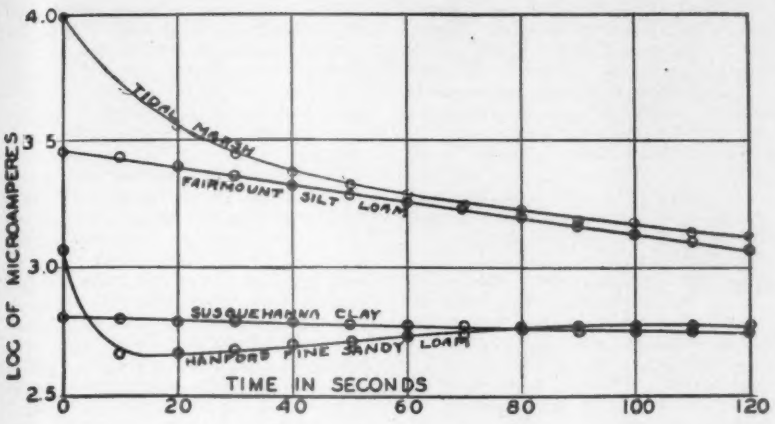

Figure 4

Normal and abnormal time-current curves

corresponding to (1) saturation, (2) the moisture equivalent (the amount of water which a soil will retain against a force of 1000 times gravity) and (3) one-half the moisture equivalent. Each mixture of soil and water was then placed in a beaker with a strip of steel, which had been carefully cleaned, rubbed with fine emery paper and weighed. The beakers were then kept in a saturated atmosphere for 48 days after which the specimens were cleaned and weighed. In Table 1 the losses of weight of the specimens are shown together with values of conductivity and galvanic current as measured at the beginning of the test.

It is evident from the table that although the galvanic current and the conductivity of the soil give some indication of the degree of corrosiveness, neither of these measurements can be considered a satisfactory measure of it. It will be observed that the acid Cecil soil corrodes the steel more rapidly than the alkaline unidentified silt loam, even though the conductivity and galvanic current of the Cecil are lower. Both galvanic current and conductivity increase with moisture content, but in every case, except the Norfolk sand, the corrosion rate is greatest at the moisture equivalent.

It has been seen that measurements of galvanic current and of conductivity indicated fairly satisfactorily the relative corrosiveness of certain groups of soils in the Middle West so far as their corrosiveness could be judged by the data available. Although the soils varied rather widely, the range of variation was not so great as that represented by certain of the soils from the Bureau of Standards test sites. From laboratory study of this latter group of soils, it was concluded that the electrical tests did not adequately indicate their corrosiveness. It was decided, therefore, to study the magnitude of the currents flowing in corrosion circuits by other methods.

IV. Polarization Measurements

1. *Measurement of Total Polarization*

The magnitude of the total effective current involved in corrosion is determined by the electromotive forces and the effective resistances of the corrosion circuits. Whenever we attempt to measure these electromotive forces we have no difficulty in finding them; in fact, it is almost an experimental impossibility to eliminate them. It may be that these potentials are an important cause of the variation in the corrosion rates of soils. They are produced by a variety of causes, both in the metal and in the soil.

There is no difficulty in explaining why soils corrode metals with potentials which can be shown to exist and with the known conductance of an assumed corrosion circuit. Such calculations make one wonder why buried pipe lasts as long as it does. It, therefore, seems logical to investigate the factors which tend to limit current flow, rather than the factors which cause it.

The effective resistance in the corrosion circuits is made up of two parts, the ohmic resistance in the soil and the various phenomena which take place at the electrodes. These latter effects can be conveniently grouped under the term polarization. The evidence which has been presented and other data from numerous sources indicate that although the conductivity does not adequately measure the corrosion rate, there is enough correlation to lead one to believe that it is an important contributing factor. It has also been shown that the methods so far devised do not adequately measure or take into account polarization on the electrodes.

The total polarization on both electrodes can be measured without difficulty if the IR drop through the cell is made small compared with the applied potential, and if the current density is sufficiently large. This can be done by simply placing the electrodes close together. The cell used in measuring polarization in soils consisted of two steel plates $5 \times 6 \times 0.7$ cm. One side of each plate was machined smooth, and to the other a terminal was attached. The soil at its moisture equivalent was placed between the plates, and the plates squeezed together, leaving a layer of soil between them one or two millimeters thick. After removing the excess soil, the cell was dipped in paraffin to prevent evaporation. In order to obtain reproducible results it was found necessary to allow the cell to stand for at least a day before the measurements were made.

The cell was then connected to an appropriate voltmeter and ammeter in the usual manner with a rheostat connected to a storage battery and used as a potential divider. The voltage on the cell was increased in steps of 0.1 or .2 volt and the current measured after one minute at each step. The voltage was then decreased in steps and the current read as before. The two current readings at each voltage were averaged and taken as the actual equilibrium current at that voltage. These current values were then plotted against the applied voltage, corrected for IR drop through the cell. The degree of polarization on the electrodes at various current densities was then shown by means of a curve of polarization voltage plotted against current density. A typical set of data illustrating the calculations involved is shown in Table 2.

In measuring polarization by the method described, it is especially important to bring the electrodes to a stable condition. This may, of course, be done by applying a small potential. If a small potential (0.3 volt) is applied to the cell for several hours before it is tested, the current at any applied voltage is very definite and stable. But the application of another stabilizing voltage will produce another curve. Hence the

TABLE 2

Typical Observations and Calculations to Obtain Current Density Potential Curve

Time	*Applied Voltage*	*Current Milliamperes Started*
10:34	.2	
10:35	.2	.572
10:36	.4	1.93
10:37	.6	3.82
10:38	.8	6.52
10:39	.9	
10:40	.8	5.96
10:41	.6	3.20
10:42	.4	1.00
10:43	.2	.10

Refore starting A.C. resistance. 41.0 ohms
After test..... 45.7 ohms
Average resistance..... 43.3 ohms
Area of plates..... 30 sq. cm.

	Calculations			
Applied Voltage	*Average Current*	*IR Drop*	*E-IR*	*Current Density*
.2	.336	.0146	.185	.0112
.4	1.46	.063	.337	.0487
.6	3.51	.152	.448	.117
.8	6.24	.27	.530	.208

most natural voltage to apply seems to be no voltage, the electrodes being stabilized simply by allowing them to remain in contact with the soil for 24 hours, as previously stated.

The current density which may be produced on the electrodes by this method is limited to about one milliampere per square centimeter. If increased beyond this limit, irregularities begin to appear and the curves are not reproducible, probably because of evolution of gases on the electrodes. In this study, the applied voltage was set at definite values and the current measured as shown in Table 2. A better comparison between soils would probably be obtained by setting the current density at definite values and measuring the applied voltage, since polarization is primarily a function of current density.

Figure 5 shows a group of curves obtained by the above described method. The curves represent results obtained with different cells. The points indicated by circles were obtained after the cell had stood one day and the points indicated by x after two days. From the figure it can be seen that the curves for a given soil at a given moisture content are reproducible and that there is a considerable difference between soils with respect to polarization. The effect of moisture changes in the soil is shown in the last set of curves in the figure.

The results of polarization measurements made on 15 soils indicate that the method is of value in estimating corrosiveness. It was found that the areas under the curves of these soils out to 0.5 volt are very roughly proportional to the losses of weight of the eight-year specimens buried in these soils in the Bureau of Standards tests. All the sandy soils have very small areas; Tidal Marsh has a very large area. Much work needs to be done on this method before its reliability can be considered as proven. It has an advantage in that it appears to indicate the degree of corrosiveness of all types of soil. If further work shows the method is reliable it could probably be adapted to general use.

2. *Measurement of Separate Polarization at Anode and Cathode*

In order adequately to investigate the value of polarization measurements for indicating the corrosiveness of the soil, it is necessary to determine how the total polarization is distributed between the two electrodes. It is possible that the polarization on the anode is a better measure of corrosiveness than the total polarization because whenever severe pitting occurs the anodic area is much smaller than the cathodic. Relatively high anodic polarization would account for the occurrence of small anodic areas.

The methods used for measuring polarization at each electrode in solutions cannot be applied to soils because of their high resistivities. Since the position of the non-polarizing electrode cannot be fixed with precision between the electrodes, the large IR drop through the soil makes the determination of the potential of the electrode with respect to the soil entirely unreliable. If a cell could be devised in which the current density on each electrode is uniform, the electrodes placed close together and one electrode made very large compared to the other, it could be used to measure the polarization on either electrode. The nearest practical approach to such a cell is to use concentric cylindrical electrodes with a large ratio of areas. The alternating current resistance of such a cell can be measured with considerable precision. Since most of the polarization will

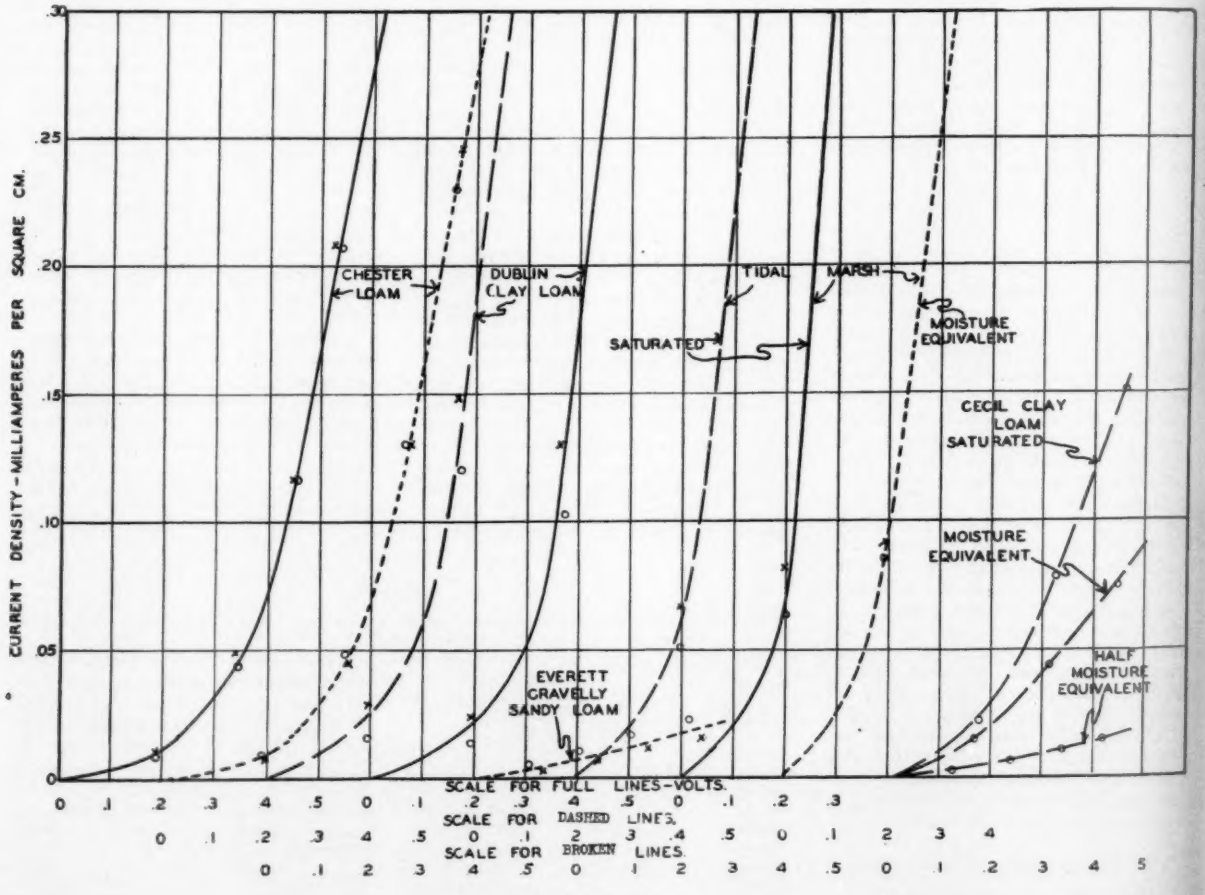
CURRENT DENSITY - MILLIAMPERES PER SQUARE CM.
.30
.25
.20
.15
.10
.05
0
CHESTER LOAM
DUBLIN CLAY LOAM
TIDAL MARSH
SATURATED
MOISTURE EQUIVALENT
CECIL CLAY LOAM SATURATED
MOISTURE EQUIVALENT
HALF MOISTURE EQUIVALENT
EVERETT GRAVELLY SANDY LOAM
SCALE FOR FULL LINES-VOLTS.
0 .1 .2 .3 4 .5 0 .1 .2 .3 4 .5 0 .1 .2 .3
SCALE FOR DASHED LINES.
0 .1 .2 .3 4 .5 0 .1 .2 .3 .4 .5 0 .1 2 3 4
SCALE FOR BROKEN LINES.
0 .1 2 3 4 .5 0 1 2 3 4 .5 0 .1 .2 3 4 5

Figure 5

Total polarization—current density curves

occur at the smaller electrode, measurements with the current flow first in one direction and then in the other will give the polarization on both anode and cathode.

In the experiments with this method, a strip of thin sheet steel, 4½ cm. by 14 cm., was used as one electrode and No. 16 iron wire as the other, both electrodes being rubbed with fine emery. The steel strip was placed in a 100-ml. beaker, soil packed in the beaker and the wire inserted in the soil to a depth of 4.5 cm. The soil in the beaker was then covered with melted paraffin and the measurements were made after the cell had stood for one day. The cell was allowed to stand for at least one hour after measurements had been made before making measurements with the current reversed. The results appear to be reproducible, to show rather small differences for most soils, and the total polarization obtained with this method appears to be in fair agreement with the results of total polarization measurements. Further studies, however, are necessary to establish the practical value of these measurements in testing the corrosiveness of soils.

V. SUMMARY

Field measurements of galvanic currents between iron and copper electrodes in a few classes of soils indicated that the most important factor influencing the current was the conductivity of the soil. Variations in voltage between iron and copper in the soils have some influence on the galvanic current. Within the limits of experimental error in these field measurements polarization was a function only of the soil conductivity. Measurements of galvanic current and of soil resistivity roughly indicated the corrosiveness of the soils tested, but laboratory trials showed that this would not be true for all types of soils.

The application of polarization measurements in the study of the corrosiveness of soils is suggested and methods are described for estimating the total polarization and the polarization on the separate electrodes in soils.

McCarter Medals Awarded

THOMAS N. McCARTER Medals and Certificates for saving the lives of two fellow workmen were presented on June 2 to Elmer Edwards and Leland F. Chapman, employees in the Gas Transmission Department of The Union Gas & Electric Company, Cincinnati, Ohio. The presentation was made before an audience of more than 300 employees of the company, who were attending one of a series of monthly educational meetings; this particular one on the subject: "Safety." Francis R. Healey, superintendent, electric distribution department, acting for H. C. Blackwell, president, made the presentation speech and handed the McCarter Awards to the honored men.

Elmer Edwards

L. F. Chapman

The McCarter Medals and Certificates were awarded to Messrs. Edwards and Chapman by the Executive Board of the American Gas Association following an experience wherein the pair of gas men saved the lives of Charles R. Stabler and John Jenkins by the prompt application of the prone pressure method of resuscitation when the latter two men were overcome by gas, while working on gas lines in Butler County, Ohio.

P. J. Keough

For saving the life of a fellow-employee who had been overcome by gas while at work at the Carondelet plant of The Laclede Gas Light Company, St. Louis, Mo., Patrick J. Keough, night superintendent, was awarded a McCarter Medal. By applying the prone pressure method of resuscitation, Mr. Keough saved the life of Wilkerson Sneed, who was overcome while engaged in clearing out gas burners.

W. J. Grunewalder

A McCarter Medal bar was presented to William J. Grunewalder, a pipefitter employed in the gas department of the Public Service Electric & Gas Company, who saved the life of a woman who had been overcome by gas in an apartment at Irvington, N. J. Mr. Grunewalder has the distinction of being the second Public Service employee to receive a bar to add to his McCarter Medal.

Whis Hufman

A McCarter Medal and Certificate were presented to Whis Hufman, gas foreman employed by the Tide Water Power Company, Wilmington, North Carolina, who applied the prone pressure method and brought about the recovery of a Wilmington citizen who had been overcome by gas. The presentation was made by F. A. Matthes, executive vice-president of the company, during a meeting of employees.

Perry Gas Making Research Report Available to Members

AT the Annual Convention of the American Gas Association, in October, 1928, suggestions were made relative to changing the composition of manufactured gas and the possibility of producing new and valuable by-products in the process of manufacturing gas.

A committee, of which J. A. Perry was chairman, was appointed to study the suggestions. As a result of this committee's report, which suggested certain studies and tests a new committee, The Perry Gas Making Research Committee, was appointed.

Under the supervision of The Perry Gas Making Research Committee, the work has been completed, including a study of the literature made by Dr. Lloyd Logan of Johns Hopkins University with the assistance of a small staff; and a study of the burning characteristics of various gases, shown in the American Gas Association Testing Laboratory Report No. 627, August 9, 1930. A limited number of copies of the report is available for the use of members of the Association who may be interested in this subject. Arrangements can be made for the loan, for a reasonable period, by application to Headquarters through company delegates. This report is of special interest to technicians and engineers who should request it through these channels. Address American Gas Association, 420 Lexington Avenue, New York, N. Y.

Monthly Summary of Gas Company Statistics

FOR MONTH OF MAY, 1932

Issued July, 1932, by the Statistical Department of the American Gas Association
420 Lexington Avenue, New York, N. Y.

PAUL RYAN, Statistician

COMPARATIVE STATISTICS OF 206 MANUFACTURED GAS COMPANIES FOR THE MONTH OF MAY, 1932

	Month of May			Five Months Ending May 31		
	1932	1931	Per cent Increase	1932	1931	Per cent Increase
Customers						
Domestic	8,836,167	9,026,515	— 2.1			
House Heating	50,598	45,426	11.4			
Industrial and Commercial	406,924	404,373	0.6	*See May*		
Miscellaneous	7,442	7,112	—			
Total	9,301,131	9,483,426	— 1.9			
Gas Sales (MCF)						
Domestic	21,995,536	22,714,519	— 3.2	109,946,355	113,777,109	— 3.4
House Heating	1,300,928	1,272,329	2.2	12,904,176	12,490,075	3.3
Industrial and Commercial	6,155,493	7,235,609	—14.9	32,858,108	36,975,877	—11.1
Miscellaneous	161,690	169,832	—	952,500	991,982	—
Total	29,613,647	31,392,289	— 5.7	156,661,139	164,235,043	— 4.6
Revenue (Dollars)						
Domestic	25,366,588	26,292,138	— 3.5	126,564,902	131,287,364	— 3.6
House Heating	950,969	1,019,354	— 6.7	9,132,038	9,588,861	— 4.8
Industrial and Commercial	5,333,944	6,215,099	—14.2	28,472,118	31,999,331	—11.0
Miscellaneous	132,220	137,687	—	609,683	741,344	—
Total	31,783,721	33,664,278	— 5.6	164,778,741	173,616,900	— 5.1
Gas Produced and Purchased (MCF)						
Gas Produced						
(a) Water Gas	13,742,900	16,114,954	—14.7	74,612,260	85,387,439	—12.6
(b) Retort Coal Gas	2,326,134	2,744,684	—15.2	12,557,049	14,198,185	—11.6
(c) Oil Gas	577,036	558,766	3.3	3,664,027	3,563,312	2.8
(d) Coke Oven Gas	3,847,270	4,701,330	—18.2	19,822,082	22,232,156	—10.8
(e) Reformed Oil Still Gas	403,100	386,001	4.4	2,027,795	1,843,955	10.0
(f) Total Gas Produced	20,896,440	24,505,735	—14.7	112,683,213	127,225,047	—11.4
Gas Purchased						
(a) Coke Oven Gas	7,464,115	9,041,731	—17.4	40,014,520	47,991,077	—16.6
(b) Oil Still and Natural Gas	5,188,089	471,079	—	26,564,864	1,875,397	—
(c) Total Gas Purchased	12,652,204	9,512,810	33.0	66,579,384	49,866,474	33.5
Total Gas Produced and Purchased	33,548,644	34,018,545	— 1.4	179,262,597	177,091,521	1.2

COMPARATIVE STATISTICS OF 207 NATURAL GAS COMPANIES FOR THE MONTH OF MAY, 1932

Customers						
Domestic (Including House Heating)	4,525,100	4,573,062	— 1.0			
Commercial	228,984	227,331	0.7			
Industrial	16,785	17,173	— 2.3	*See May*		
Main Line Industrial	5,602	5,567	0.6			
Miscellaneous	2,026	2,522	—			
Total	4,778,497	4,825,655	— 1.0			
Gas Sales (MCF)						
Domestic (Including House Heating)	19,983,101	23,097,697	—13.5	149,922,582	163,158,899	— 8.1
Commercial	2,877,550	3,219,188	—10.6	24,719,750	25,204,635	— 1.9
Industrial	14,089,931	16,015,710	—12.0	74,488,635	85,252,894	—12.6
Main Line Industrial	10,798,154	14,292,518	—24.4	56,847,156	69,516,078	—18.2
Miscellaneous	571,744	623,720	—	3,232,736	2,988,464	—
Total	48,320,480	57,248,833	—15.6	309,210,859	346,120,970	—10.7
Revenue (Dollars)						
Domestic (Including House Heating)	14,448,572	16,048,595	—10.0	100,565,332	108,171,273	— 7.0
Commercial	1,469,029	1,617,435	— 9.2	11,499,748	12,013,513	— 4.3
Industrial	2,968,263	3,771,426	—21.3	16,353,969	20,425,681	—19.9
Main Line Industrial	1,310,594	1,829,585	—28.4	7,068,582	9,156,737	—22.8
Miscellaneous	85,768	88,780	—	540,580	511,266	—
Total	20,282,226	23,355,821	—13.2	136,028,211	150,278,470	— 9.5

Gas Utility Revenues Show Drop in May

REVENUES of manufactured and natural gas utilities aggregated $52,065,947 in May, 1932, as compared with $57,020,099 in May, 1931, a decline of 8.7 per cent, according to reports from 413 companies serving 14,079,628 customers and representing 90 per cent of the public utility distribution of gas. For the first five months, revenues of these companies totaled $300,806,952 compared with $323,895,370 in the same period of 1931, a drop of 7.1 per cent.

For May, the manufactured gas companies reported revenues of $31,783,721, or 5.6 per cent less than a year ago, while the natural gas utilities reported revenues of $20,282,226, a decline of 13.2 per cent. For the first five months, manufactured gas revenues registered a decline of 5.1 per cent and natural gas revenues a drop of 9.5 per cent.

Sales of manufactured gas reported for May totaled 29,613,647,000 cu.ft., a decline of 5.7 per cent, while natural gas utility sales for the month were 48,320,480,000 cu.ft., a drop of 15.6 per cent.

The decline in natural gas sales in May was the severest shown this year and was due to a contraction in all classes of sales. The drop in natural gas sales was general throughout the country with the exception of California, where an increase of 21 per cent in domestic sales and 62 per cent in commercial sales, offset declines in industrial sales and resulted in an increase of 1.4 per cent in total natural gas sales. Revenues of natural gas companies in California show an increase of 12 per cent for May and 15 per cent for the first five months.

Declines in manufactured gas sales were more or less general in May, particularly in those regions where large volumes of gas are sold for industrial purposes. However, manufactured gas sales on the Pacific Coast and in the West North Central States show slight increases in May and for the first five months, as compared with the same period of 1931.

Instructions for the Testing and Repairing of Gas Meters

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By

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Obituaries

C. Y. Bowers

C. Y. BOWERS, thirty-seven years old, of Tacoma, Washington, vice-president and general manager of the Washington Gas and Electric Company in charge of its western property, died in a Tacoma hospital July 6.

Mr. Bowers was formerly manager of the Longview branch of the Washington Gas and Electric Company, leaving there four years ago for Tacoma.

Mr. Bowers was born in Shelbyville, Ind. He was a World War veteran of the aviation service, a member of the Masonic lodge, the Tacoma Country Club and the American Gas Association.

Minimum Requirements for Gas Burning Household Appliances

(Continued from page 355)

ment of minimum standards, tremendous strides in the improvement of all gas burning household equipment have been made in the last few years. Not only has this development taken place in the beauty and appearance of the appliance but also in its safety, convenience, usefulness, automatic operation, flexibility and general satisfaction in performance. During the seven years that approved appliances have been available so many complimentary letters have been received from satisfied users, and complaints to manufacturers concerning appliance operation have so materially decreased that the practical value of this work has demonstrated that it is no longer in the experimental stage. In fact, the program has progressed so far that it may be said without fear of contradiction that very few, if any, industry's equipment has been standardized as effectively in the customer's interest as it has been in the gas business.

Local Companies Aid National Contest to Help House Heating Sales

(Continued from page 329)

uting Co., Ogden, Iowa; Minnesota Northern Natural Gas Co., Wells, Minn.; New York State Electric & Gas Corp., Ithaca, N. Y.; Empire Gas & Electric Co., Geneva, N. Y.; New York Central Electric Corp., Penn Yan, N. Y.; Hoisted-Romaine Co., Newburgh, N. Y.; A. C. Smith Plumbing Co., Newburgh, N. Y.; New Jersey Power & Light Co., Phillipsburgh, N. J.; New York Power & Light Corp., Albany, N. Y.; Keystone Gas Co., Inc., Olean, N. Y.

Master Plumbers Find Cooperative Merchandising Plan Success in First Year

(Continued from page 327)

do, this will be launched within the next few months. This plan calls for a definite tie-in between the national program and the activities of local gas companies. I believe it will mean greater activity in the field of appliance merchandising than any we have known before. So far as the companies I represent are concerned, all of their appliance advertising in connection with this campaign will continue to feature the symbol which we have used so effectively in our territory, and which emphasizes the phrase *Buy approved gas appliances from your plumber, dealer, or gas company.*

"This, then, is a brief review of what we think and feel about this important matter of sound trade relationships. It has always been a subject of the deepest interest to me, going back in some of its elementary aspects to personal experiences of nearly thirty years ago. May I say to you frankly that I do not think we would ever have gotten very far, if it had not been for the broad vision, the tolerance and the human understanding of such men as T. P. McLaughlin, your past President George H. Drake, J. L. Murphy, President Donoghue, and Mr. Feeney, the last three constituting the committee which has worked in such a friendly and constructive manner with our organization in the last year or two. I think your association owes those men a debt of gratitude, and we in the Gas Association certainly feel that we do."

Plan to Make A. G. A. Convention A Sign Post on Road Toward Upward Trend

(Continued from page 324)

Industrial Gas Section

The theme of the two-day session of the Industrial Gas Section will be sales promotion. Recognizing the important part which research plays in the promotion of the use of gas in industrial fields, a very comprehensive paper on that subject will be presented.

The subject of competition from other fuels will be covered in an address by a well-qualified utility executive.

The Industrial Gas Section will attempt an innovation this year in holding a round table sales conference in place of a formal session and at this conference intimate discussion will be had on the subject of sales methods.

Also, in view of the peculiar interest in the hotel and restaurant market, a good portion of the discussion at this conference will be the hotel and restaurant sales problems.

The Natural Gas Department

One session of the Natural Gas Department is scheduled to take place at 2 o'clock, Monday afternoon at the Ambassador Hotel. An interesting program of subjects of particular interest to the natural gas man is promised, and details will be announced as soon as possible.

Publicity and Advertising Section

Prominent figures from within and without the gas industry will address the meeting of the Publicity and Advertising Section upon timely angles of utility advertising, promotional work and general publicity. This meeting will take place Wednesday afternoon, October 12, in the Japanese room at the Ambassador Hotel.

Technical Section

The Technical Section will summarize the results of its three-year research in pipe joints. A prominent distribution engineer will supplement this with the story of pipe-joint practice as he sees it.

A subject of growing importance—"Appliance Servicing"—will be introduced from the distribution engineer's viewpoint, and it is hoped will be jointly discussed with representatives of the Commercial Section whose committee has made a thorough study of this subject.

Gum problems, recent developments in purging apparatus, the latest innovations in gas production, and gas conditioning,—all will reflect the care with which our committees have kept in touch with the progress of the last year.

These are but the high lights of the thought and care that is being bestowed on preparing the program of this year's convention.

1931 PROCEEDINGS

OF THE ANNUAL CONVENTION OF THE

American Gas Association

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BOOK OF THE YEAR

IN its official publication, the Wisconsin Utilities Association characterizes the latest edition of the A. G. A. PROCEEDINGS as "BOOK OF THE YEAR." Under this caption, the following paragraph appears:

> "The Gas Man's Book of the year has arrived—the 1931 A. G. A. PROCEEDINGS. There are over 1,200 pages of reports, addresses, discussions and charts, illustrations and drawings. It seems as though there should be a copy for each employee in a position where he must keep up-to-date. The forms, devices and methods of the accounting department are there in detail; rate questions are discussed, tabulated and charted. Commercial and industrial problems receive full consideration. Advertising, manufacturing, technical and research subjects all appear in this famous book. You can even get some good stories. It is like the dictionary and the encyclopedia—just what you should have close by for frequent reference. If you have one, use it and share it. If you do not have one, borrow from the nearest member."

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ADDRESS

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Gas Appliance and Equipment Developments

Contributions of news items by manufacturers of gas appliances and equipment to this department will be welcomed by The A. G. A. Monthly. On account of space limitations, all announcements of new products, improvements, etc., should be limited to about 100 words. No attempt will be made to describe each product or give details of construction. For such details address the manufacturer direct. Where justified, photographs will be used to illustrate these brief items. All contributions to this department should be addressed to C. W. Berghorn, Secretary, Manufacturers' Section, American Gas Association, 420 Lexington Ave., New York, N. Y.

Paints for Water Tank Interiors

The Pittsburgh-Des Moines Steel Company and the Borough of Ambridge, Pa., which are jointly conducting an extensive test of paints for the interior of water tanks, have announced the results of the eighth inspection of the 196 paint panels made after 213 days' exposure. A preliminary report of this test, containing detailed information as to the manufacturers' names, kinds of paint, price per gallon, spreading rate and approximate cost per 1000 sq.ft. of the paints having the best ratings will be published by the Pittsburgh-Des Moines Steel Company and copies may be obtained upon request to the company at 3408 Grand Avenue, Neville Island P. O., Pittsburgh, Pa.

"Patrol Flash"

The Patrol Valve Company, Cleveland, Ohio, has announced that its most recently developed automatic lighter, "Patrol Flash," is receiving wide acceptance among range manufacturers. It is claimed that this method of automatic ignition and re-ignition reduces hazards and is adjustable in all directions to meet the requirements of the individual range.

Salesmen's Booklet

"Selling Direct to the Home" is the subject of a booklet which merchandisers have found useful in aiding appliance salesmen to approach direct-to-home selling on a psychological basis. Sales managers of gas utility organizations and gas appliance dealers will be furnished sample copies upon request to Adams Bros. Manufacturing Co., Inc., 1500 W. North Avenue, Pittsburgh, Pa.

Control Conversion Units

Lee B. Mettler Company, 406 South Main St., Los Angeles, Calif., has published a booklet describing its latest developments, the Series "C" Conversion Burners and the Mettler Improved Automatic Safety Pilot. The Series "C" burner is built on the entrained combustion principle and is so arranged that complete combustion takes place close to the end of the burner with a minimum amount of excess air and high furnace temperatures. The Mettler safety pilot is of simple construction, consisting of only three parts, and is designed to give economical service with safety. The company will furnish additional information upon request.

"RegOroD"

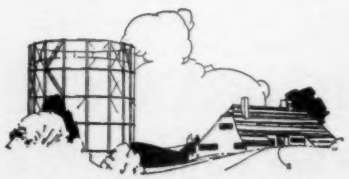
Under the trade name of "RegOroD," The Bastian-Blessing Company, 240 East Ontario Street, Chicago, Ill., has introduced a line of welding rods and electrodes to be sold through Rego Distributors. The new "RegOroD" catalog, prepared in pocket size, gives a description of each rod and information in reference to the proper rod for use in specific applications. It also contains a number of tables for the use of the welder and welding engineer. Copies will be furnished upon request to the company or any of its distributors.

New Type Water Heater

The Ruud Manufacturing Company held a sales meeting in Pittsburgh, Pa., on June 29 and 30. At this time all district sales managers and field representatives were present. The sales meeting covered a demonstration of the new Ruud Customer Control type water heater. This is said to be the newest development in the water heater business in ten years and undoubtedly will prove interesting to the gas trade. The sales conference covered every phase of the demonstration and sale of this unit.

Has New Department

The Sonner Burner Company has announced the formation of a sales engineering department at its manufacturing plant and foundry at Winfield, Kansas.



Walter H. Hoagland, who recently resigned as gas sales supervisor of the Kentucky-Tennessee Light & Power Company, is in charge of the department.

Linde Products

The Linde Air Products Company, 30 East 42nd Street, New York, N. Y., has announced that substantial reductions in the prices of Oxweld Welding and Cutting Blowpipes are now in effect. Two new regulators, the Oxweld Type R-48 Oxygen Regulator and the Oxweld Type R-49 Acetylene Regulator, have been added to the line of Oxweld welding and cutting apparatus. These new regulators are designed to provide the Oxweld line of apparatus with a pair of lighter duty regulators. Another late development is the Oxweld Extensometer, a new testing device which makes it possible to determine the yield point of specimens being tested in an Oxweld Portable Tensile Testing Machine. The sensitivity of the Oxweld Extensometer is such that it will indicate the elongation in a standard A.S.T.M. test specimen occasioned by the heat of the human hand.

Worthington Developments

Worthington Pump and Machinery Corporation, Harrison, N. J., recently has issued new catalogs or bulletins on the following products: Multi-V-Drives (rubberized cord belts operation in V-grooved sheaves); rock drills; air compressors, vertical single-cylinder, two stage; Diesel engines, stationary; Diesel engines, marine; gas engines, vertical; and water meters, disc type. Copies of these publications will be sent upon request. Other announcements describe the following developments: A new model water meter, known as Model GA, and said to be the most accurate yet developed for extremely low flows as well as for intermediate and high flows, has been added to an already extensive line. A new line of direct acting steam pumps, known as the "Hivol," has been introduced. This line features extremely close clearance and was designed to handle "wild" fractions—casing head gasolines, butanes, and propanes—and other volatile liquids.

Consolidates With Buffalo Plant

Worthington Pump and Machinery Corporation, with executive offices at 2 Park Avenue, New York, and general offices at their Harrison, N. J., Works, has announced the decision to transfer and consolidate the designing, engineering and manufacturing activities formerly carried on at their Cincinnati, Ohio, Works with those of their Buffalo, N. Y., manufacturing plant.

Associations Affiliated with A. G. A.

Canadian Gas Association
Pres.—Hugh McNair, Winnipeg Electric Co., Winnipeg, Man.
Sec.-Tr.—G. W. Allen, 21 Astley Avenue, Toronto.

Empire State Gas and Electric Association
Pres.—Alfred H. Schoellkopf, Niagara Hudson Power Corp., Buffalo, N. Y.
Chairman, Gas Section—F. C. Weber, The Brooklyn Union Gas Co., Brooklyn, N. Y.
Sec.—C. H. B. Chapin, Grand Central Terminal, New York, N. Y.

Illinois Public Utilities Association
Chairman—A. D. Mackie, Illinois Power Co., Springfield, Ill.
Sec.—J. R. Blackhall, 617 Public Service Bldg., Springfield, Ill.

Indiana Gas Association
Pres.—F. X. Mettenet, Public Service Company of Indiana, Indianapolis, Ind.
Sec.-Tr.—P. A. McLeod, New Castle, Ind.

Michigan Gas Association
Pres.—J. E. Spindle, Grand Rapids Gas Light Co., Grand Rapids, Mich.
Sec.-Tr.—A. G. Schroeder, Grand Rapids Gas Light Co., Grand Rapids, Mich.

Maryland Utilities Association
Pres.—F. A. Mitchell, Eastern Shore Public Service Co., Salisbury, Md.
Sec.—D. E. Kinnear, 803 Court Square Bldg., Baltimore, Md.

Mid-West Gas Association
Pres.—W. E. Derwent, Geo. D. Roper Corp., Rockford, Ill.
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Missouri Association of Public Utilities
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Fourteenth Annual Convention of the American Gas Association
Atlantic City, N. J. - - - October 10-12, 1932

Personnel Service

SERVICES OFFERED

Gas engineer (38) B.S. in M.E. Sixteen years in the gas industry, starting operating period as cadet and ending as superintendent of combination plant. Last eight years with large gas plant equipment manufacturers, last two years as chief engineer. Experience ideal for plant or holding company engineer. **575.**

Merchandising manager available for manufacturer of major "load builder." Has practical utility-dealer cooperative plan of proven acceptability. Will contact operating companies and arrange "set up," also personally create and supervise dealer organization. Familiar with procedure where holding company maintains an approved list. **577.**

Industrial engineer; college graduate (32) several years' experience in both manufactured and natural gas sales, design and combustion. House heating experience. Acquainted with change-over of gas equipment from manufactured to natural gas. Electrical experience also. **578.**

Industrial engineer, (sales) experienced in all branches of industrial furnace application, including surveys, sales and competitive fuel situations, as well as furnace operation; wide experience in both natural and manufactured gas installations; thorough understanding of general sales policies and methods of procedure. **580.**

Manager (Cornell Graduate), at present employed desires responsible position with gas company. Ten years' experience covers manufacture, distribution, merchandising and office work. Excellent record. Age 33. **581.**

Contact man for manufacturer of gas equipment or gas company. Experienced in gas heating engineering and sales, both natural and artificial gas. Can organize department and train men. **585.**

Sales engineer, (38) technical graduate. Seven years' experience in the installation and operation of natural gas fired power steam boilers. Six years' experience selling auxiliary power plant equipment to public utility and industrial power plants. Fitted to negotiate natural gas sales to this type consumer. **588.**

Experienced salesman (36) familiar with sale and servicing of all types of gas burning appliances desires position with manufacturer or gas company. Will locate anywhere. Has own car and will travel. Married. **589.**

Operating and **experimental** engineer now with largest manufacturer and operator of by-product ovens. Specially qualified in maintenance and repair work on older plants. Has conducted large scale experimental work, including design, as well as actual operation. Graduate Engineer (36); background university instructor followed by Teaching Fellowship, Carnegie Institute of Technology. **593.**

Mechanical engineer, Master's degree, three years' oil refinery process and control equipment specifications and selection. Two and one-half years' steam power plant operation, testing, maintenance, equipment specifications and selection. Three years' general design, construction and inspection. Desires place involving specifications, purchase, design, maintenance, operation, test or construction. **594.**

Executive (46) eighteen years' practical experience in the stove and foundry business, both gas and coal, in sales and production, desires connection. **595.**

A man who does not flinch at duty. Who knows plant operations, phases of distribution, high and low pressure, office routine, rate structure, merchandising, who can superintend and manage a company's affairs efficiently; practical and technical contact on the firing line together with supervision in a **managerial** and executive capacity. **596.**

SERVICES OFFERED

Manager with experience in manufactured and natural gas and electricity with an excellent record of constantly increasing revenue. Particularly qualified in electric competition and have met it successfully and uniquely. Full details of experience furnished on request. **597.**

Gas engineer (30) B.S. in M.E. Eight years' experience as cadet, engineering assistant, acting water gas plant foreman and assistant superintendent of meters in medium and large situations. **598.**

Merchandise man with twelve years' of diversified experience with gas and electrical appliances, five years of this experience as a manufacturers' representative to the utility and trade. **599.**

Chemical engineer, Master's degree, Columbia. Six years' experience in manufactured gas, coal and coke, and oil refining. Plant and process development, design and sales. Thoroughly acquainted operating processes, utilization of fuels, design and sales of furnaces, heat exchangers, bubble towers, etc. Age 31, married. **600.**

Mixed gas control—**engineer** (technical graduate) recently with internationally known manufacturer of gas mixing and combustion control equipment. Experienced in design, installation and operation of combustion control systems, also power plant operation and test experience; charge of installation and operation mixing equipment for manufactured and natural gases. Age 32, married. **601.**

Advertising director—fifteen years in agency and public utility field. Experienced in gas and electric appliance merchandising, holding company institutional and educational copy, and preferred stock advertising under customer ownership plans. **602.**

Sales representative with leading manufacturer for the last two years, intensively covering utility and municipal fields in New York, New England, New Jersey and Pennsylvania, offers valuable contacts to concerns selling to or through gas and electric companies. Hard worker, good producer, thoroughly reliable. Available immediately on salary or drawing account basis. **603.**

Draftsman, designer, wiring man, labor cost clerk, specifier, material man, checker and shop inspector, also having experience in field surveying and building department filing. Has had ten years' experience with nationally known organizations. Technical college training. **604.**

Gas **manager,** now employed, married, age 31, desires new connection: thirteen years' experience in coal and water gas operations and distribution. Can plan and supervise construction work. Understands merchandising and customer relations. Can furnish excellent references and reports on past and present results. **605.**

Engineer or assistant to executive. Familiar with design and application of **rates** in the manufactured or natural gas industry and negotiation of rates with municipalities. Experienced in preparation of rate cases and public service commission practice and rate procedure in a number of states. Electric experience also. **606.**

Superintendent (45) who began by digging ditches and was advanced up through street foreman to sales manager; experience includes coal, water and natural gas. A man who has never had labor trouble and does not mind how many hours he works. High and low pressure distribution experience. **607.**

General manager (graduate engineer) of natural gas distributing company with exceptional experience in building industrial load in new territory. Thoroughly familiar with engineering design and sale of manufactured gas plant equipment and accessories. Knows coke oven practice and has also had valuable experience in essential gas purification research work. **608.**

SERVICES OFFERED

As **engineer,** general superintendent or assistant manager. Can bring to an operating or holding company experiences rich in low cost operation, economical design, planning and construction of plants and distribution systems. Have held responsible positions with equipment and operating companies. **609**

Sales engineer, capable of managing department with experience in house heating work covering surveys, estimates, sales promotion, service, installation, repairs and maintenance, also industrial steam boiler application and water heating covering large volume. Broad general and technical knowledge. Married. **610.**

Public relations: for the organization whose problem remains basically one of human relationships and public opinion, a publicity counselor of broad newspaper, editorial, advertising experience. Knows public utility finance and security promotion. Has national press and financial contacts. Original, resourceful, practical, writes well and organizes carefully. College trained, married. (30). **611.**

POSITIONS OPEN

Manufacturers' agents wanted in a number of territories to take on complete line of warm air furnaces and air conditionings. **0236.**

Domestic **gas appliance salesmen** for work with **gas** company in the South. Liberal commission basis, permanent position. **0238.**

Manufacturer of approved gas appliances wishes representation, through **manufacturers' agents,** for gas thermostatic controls. **0239.**

Manufacturers' agents and **salesmen wanted** by manufacturer of gas boilers and furnaces, also residence air conditioning systems. Commission basis. Advise lines now handling, and territory covered. **0240.**

Large nationally known manufacturer of automatic water heaters in complete price range, desires **distributor** for Columbus, Ohio territory. An attractive and exclusive franchise is available. **0242.**

Distributorship on complete line nationally known automatic water heaters for Dayton, Ohio territory is available. No missionary work to be done. Real opportunity for live organization. In writing, advise lines now handling. **0243.**

Manufacturers' agents wanted to contact utilities for nationally known water heater manufacturer with complete line of A. G. A. approved gas water heaters. Commission basis. Advise lines now handling and territory covered. **0244.**

Manufacturer of conversion gas range burner for use in coal and wood ranges, or combination coal, wood and gas ranges, desires to place commission **salesmen** or factory representatives outside of New England States, especially in the natural gas territories. Prefer men acquainted with the gas utility trade; have no objection to salesmen or factory representatives handling other non-conflicting lines along with our product. **0245.**

Manufacturers' agents wanted in a number of territories by manufacturer of gas boilers. Commission basis. Advise lines now handling and territory covered. **0247.**

A special packing for pipe joints which finds ready acceptance with distribution engineers is offered as a profitable side line to **salesmen** calling on gas and water companies. **0248.**

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